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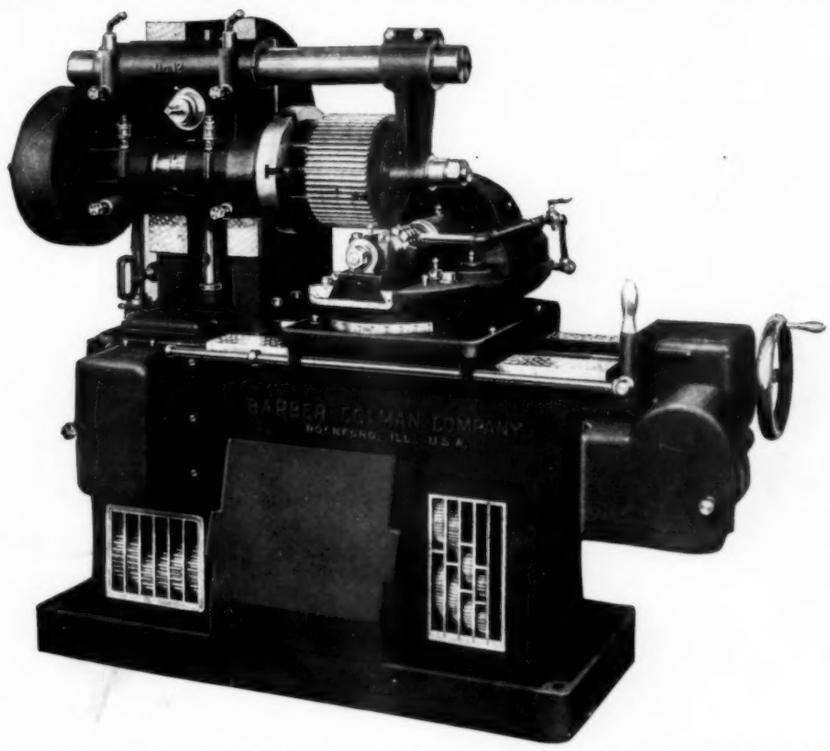
A MANUFACTURING GEAR HOBBING MACHINE



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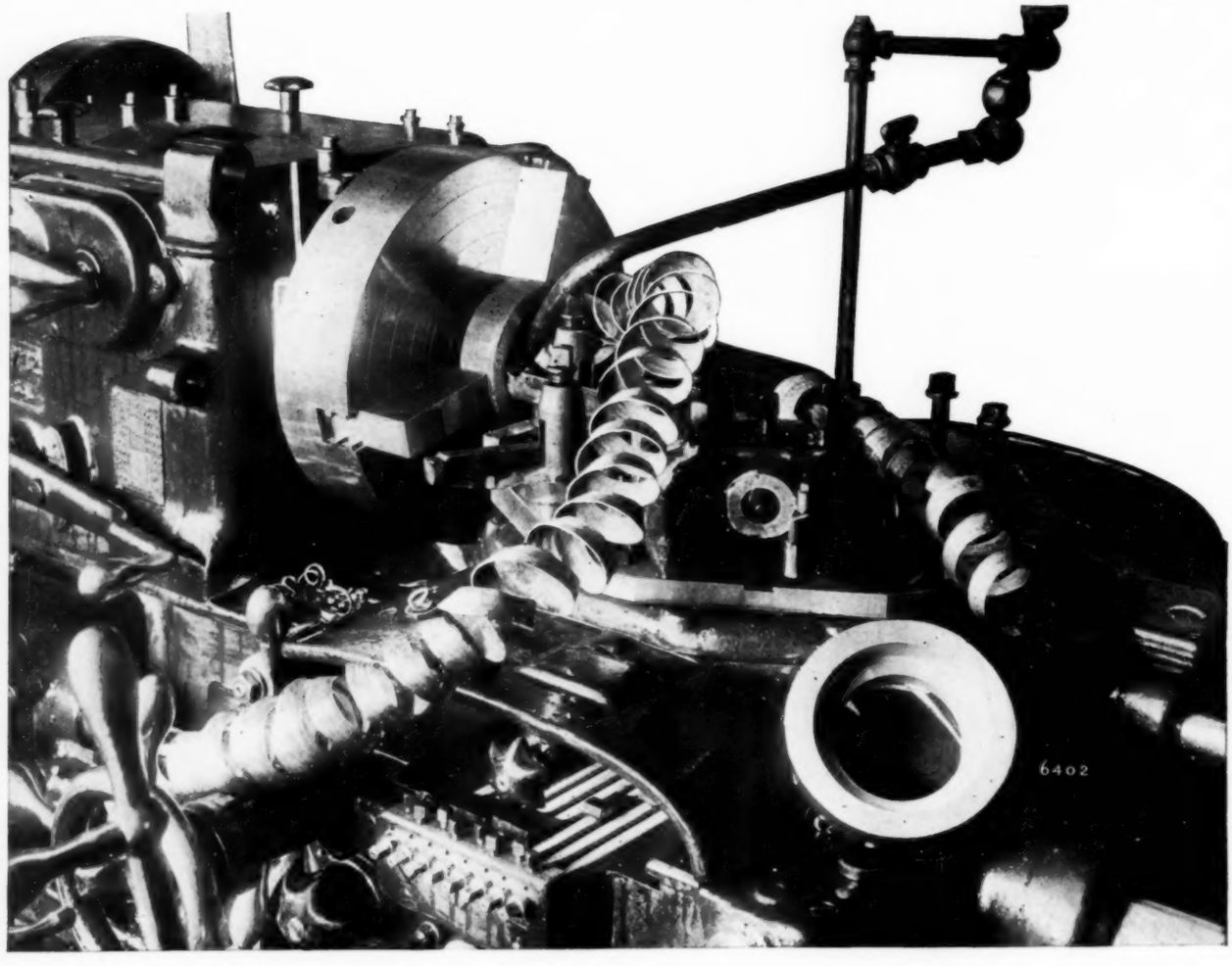

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Aluminum as a Material for Jigs

By F. A. Stanley*

Extensive application of this light metal in the construction of drilling jigs is being made in the factory of a prominent scale manufacturer. It has been found well suited to the purposes indicated and the work handled in this manner has proved satisfactory in every respect.

Advantages of lightness and consequent ease of manipulation are obtained with the aluminum jigs, and in many cases the output is undoubtedly considerably greater than would be the case with cast-iron fixtures whose weight would tend to a certain extent to retard the ready movement of the work under different drill-press spindles.

Details of construction with typical examples of work drilled with these tools and some explanation of modifications incorporated to render the jigs of the greatest service.

*Western editor.

A feature of the shop practice of the Computing Scale Company, of Dayton, Ohio, that has not been touched upon in the preceding articles upon their plant, is the extensive and increasing use they are making of aluminum in the construction of jigs for drilling different parts of weighing scales. In machining these scale parts there are various pieces that, although light in section and requiring the drilling of small holes only, are yet of fairly good size and if handled in the customary cast-iron jigs, would necessitate the shifting about of considerable weight, in bringing the work under the different drill-press spindles. So in numerous instances the shop has adopted the much lighter material, aluminum, for the purposes indicated.

General Observations

Aluminum has been used in some few cases in other shops for jigs for drilling aluminum in order to provide a complete safeguard against variations in two different lots of work drilled at different times and possibly under widely differing conditions as to temperature, it being considered that any changes in the parts to be drilled owing to temperature variations, would be duplicated by the change in the jig itself, so that trouble from this source with two lots of work handled under different circumstances, would be avoided. With this in mind, one is inclined, at first, to ask if any troublesome discrepancies creep into different lots of iron castings drilled with aluminum jigs.

Experience of several years' duration with jigs of this material has demonstrated to the computing scale mechanics, that anticipated troubles of the nature suggested do not develop in actual practice; that the jigs prove eminently satisfactory for the classes of work they are constructed for, and that while much of this work requires to be drilled with accuracy in order to assemble and interchange properly, all requirements along this line are fully met with the jigs of aluminum. The fact of the matter is, in any modern, properly heated shop, there is less real probability of trouble of the nature suggested from wide temperature variations, than from a number of other sources which would have an equal effect upon both cast iron and aluminum jigs; for example, the interference of chips and dirt with the proper operation of the jig, the springing of work in setting and clamping it, the wearing of guide bushings and the "running" and "cutting large" of drills and reamers.

Obvious Advantages

When it comes to the handling of the jig under the drill press, every advantage attaches to the aluminum tool. In the first place, the man who takes it from the tool storage, can move it with little effort, and even very large jigs can be picked up by two men with little trouble, as compared with the same size appliances made of cast iron. When placed upon the drill-press table, and especially where it must be moved about under several different spindles, its lightness is a decided advantage to the operator, and incidentally to the machine itself.

It is quite commonly the case that drill jigs weigh considerably more than the work they handle and this is especially true with box jigs and designs generally in which the work is practically inclosed in a receiving shell, either with or without a lid. In the manipulation of such jigs, the weight is a decided drawback and forms an important factor in retarding the daily output, merely through the extra effort it forces the operative to put forth. Furthermore where it is desired to drill small holes in large work, a heavy jig imposes an unnecessary burden upon the table of the light drilling machine, and oftentimes work is placed under a larger machine than is really desirable for the small-hole drilling, simply because the more sensitive driller may not be provided with a table sufficiently rigid to carry without deflection a fairly large piece of work, when in addition the weight of a heavy cast-iron jig has to be supported.

There is a variety of work of this character at the Computing Scale Company's plant, which is jig-drilled in sensitive machines under a row of spindles, with the piece slid from one position to another for different operations, the jig being carried upon a special table of ample area to permit the work to be swung about to every position required without overhang. The aluminum jig is particularly convenient here, and undoubtedly it adds greatly to the output from each machine, as well as reducing "wear and tear" on machine and operator.

Some Typical Examples

A typical jig base of aluminum is shown in the halftone, Fig. 1, as clamped to an angle iron on the surface plate while a series of hole-locating devices, Fig. 2, are being secured to its lugs by the toolmaker. It so happens that this jig is undergoing certain modifications that render necessary the relocation of some of the holes, but the method of locating hole centers for correct spacing between drill bushings, is quite as applicable to entirely new jigs, and is well worthy of description, as it is entirely different from the customary methods of procedure in such cases.

A larger aluminum jig is illustrated in Fig. 3, with the casting it is used for drilling, shown to the right. This is a base for an "Insurance scale" and the jig is about three feet long by eighteen inches wide. The work is seen in position in the jig, in Fig. 4. In each view a two-foot rule is included to give an idea of the general dimensions of work and jig.

Another example of aluminum jig construction is represented by Fig. 5, which shows a lid-jig with the cover swung up to reveal the interior, with its ingeniously arranged stops and work-locating mechanism. The castings (right-and-left-hand) which it drills are seen, and form the "case-front" and "case-back" for a type of computing scale in which a fan-shaped chart is carried for indicating weights and commercial values. This jig approximates an over-all area of 15 by 18 inches.

Locating Hole Centers

Returning for the moment to the operation illustrated in Fig. 1, a few words may be devoted to an explanation of the locating buttons and their carrying plates, which the toolmaker in the view is represented as testing in reference to the working surfaces of the jig.

The "buttons" seen at *A A*, Fig. 1, are really solid plugs, and are seated in small steel plates of about the size shown in Fig. 2, which is a sketch made to indicate the general principle without strict adherence to any definite proportions, these, of course, being varied by the toolmaker to suit the conditions of the work upon which he happens to be engaged. The plug in the plate is merely the means by which the latter may be located by hight gage, micrometers, size blocks or other devices, and clamped, after which the plug or button is withdrawn from the hole in the plate and the plate used as a guide for the tool which forms the hole.

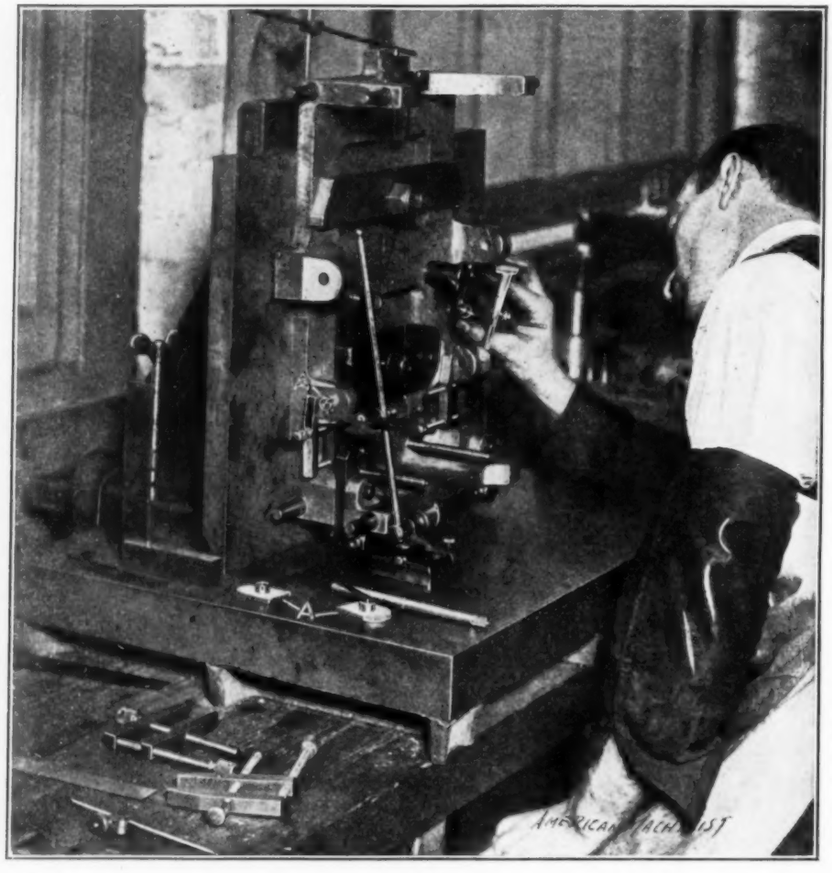


Fig. 1. Setting Locating Buttons on an Aluminum Jig Prior to Boring

The Tools for the Holes

Ordinarily the scheme shown is applied in connection with a counterbore, and this means that the hole in the jig may be first laid out approximately, centered and drilled out roughly to size, then the locating plate, Fig. 2, is slipped over the hole, set in exact position, and clamped, the plug then being removed and a counterbore run through to enlarge the hole to the correct size and give it at the same time the correct location. The pilot of the counterbore naturally is not required in this operation (the plate serving as a guide) so the hole first put through the jig before the application of the locating plate, is sufficiently large to clear the pilot of the counterbore that is to be used.

It is apparent that a rose bit or a D-drill can be used in similar fashion to the counterbore, but the latter is usually available where the other tools are not and would have to be made to suit the job. Also, if desired, the locating plate might be employed in connection with a special spotting drill for positioning the hole correctly at the outset, following this with a smaller twist drill for roughing out the hole without touching the guide hole in the locating plate. While the precise method of starting and finishing the hole may be chosen to conform to individual preferences or to the facilities at hand, it is evident that the locating plate must be subjected to as little wear as possible from the cutting tools if the best possible results are to be expected.

The actual operation of finishing the hole may be accomplished in either the milling machine or the drill press.

Position of the Jig upon the Knee

The jig in Fig. 1 is represented as clamped vertically to the knee or angle plate, and two surface gages with indicators attached, are applied in the operation of setting the locating plates to the required positions. At first sight, it is not entirely clear that the work of locating these devices could not be proceeded with more satisfactorily with the jig placed flat upon the bench plate. Certainly the light would not be obstructed to the same degree as with the tall knee intervening between the toolmaker and the window, and the jig could be more easily squared up and clamped in place if allowed to rest upon its base instead of in the vertical position represented.

However, when we consider the fact that the holes to be located are quite close to the base of the jig but some distance from either end, it becomes apparent that if placed upon its base, with one end abutted against an angle plate, the longer and heavier of the two surface gages would have to be used—with its base on the perpendicular face of that angle plate, making the locating process much more tedious and presumably resulting in a lesser degree of refinement than is secured under the conditions represented in the engraving.

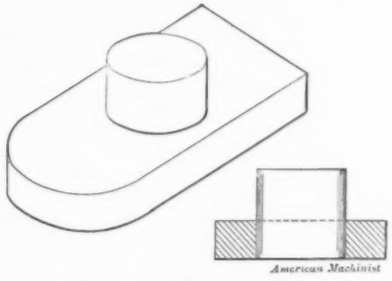


Fig. 2. Button Plate for Locating Bushing Holes in Drill Jigs

Aluminum Jig Details

The jig in Fig. 1, like the others shown, is provided with hardened-steel feet, and, of course, with steel-locating stops, clamps, etc. It will be seen that generally speaking, the section of metal at different points in the aluminum castings, is little if any heavier than would appear in designs for cast-iron jigs for the same purposes. There is, however, a greater amount of stock in the bosses into which the bushings are pressed, and, for the same reason, the lugs for carrying the lids, and certain clamp supports are somewhat thicker in cross-section than would be the case with cast-iron jigs. And by the way, in fitting bushings, feet and stops of various kinds, less allowance is made for driving in place, as the metal is more susceptible to strains due to these and similar causes,

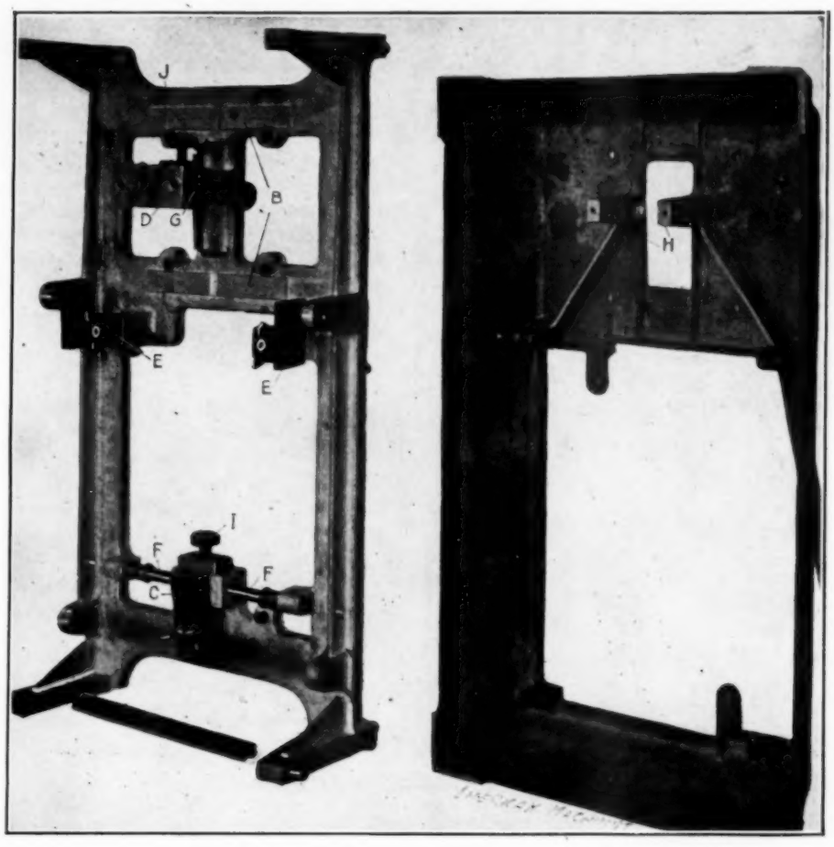


FIG. 3. LARGE ALUMINUM JIG AND THE WORK

and possible trouble from such sources is avoided by making the parts mentioned simply a nice snug fit, which permits them to be pressed into place easily and without disturbance of the surrounding metal.

Bushings for drills as large as ¾ inch have been used here in aluminum jigs, and for bushings of any such size as this it is the practice to use a liner bush in the hole bored in the jig, into which in turn the drill-guide bushing is fitted. This reduces possibility of direct wear around the bush and permits easy replacement of worn bushings.

WORK CLAMPS, THUMB NUTS, ETC.

The clamps for the work are so placed in reference to the work supports as to obviate possibility of straining the aluminum frame in tightening up. The lids of box jigs are constructed to close squarely upon broad seats on the jig body, and instead of a nut, cam handle, or similar device for securing the lid when closed, there is a button that when turned a quarter way round, prevents the lid from moving, yet imposes no strain whatsoever upon it. Set screws that might present possibilities of overstress of the jig if tightened carelessly, are dispensed with, and practically all work-holding mediums take the form of thumb nuts, thumb screws, or finger-controlled devices of other forms that preclude all likelihood of the workman's clamping the piece more tightly than is considered desirable.

These precautions of design have been fully justified by the results derived after an extended period with jigs of this type, and it has been the case usually that the very devices incorporated to prevent springing of the jig and work have also rendered the operation of the jig more convenient and to just that extent increased its productive capacity.

HOLDING A SCALE BASE

Referring again to the jig illustrated in Figs. 3 and 4, it may prove of interest to consider a few of its features in detail. As already stated, this jig is utilized for drilling the insurance-scale base, seen to the right in Fig. 3 and shown in place in the jig in Fig. 4. The casting to be drilled rests upon planed surfaces in the jig at *B*, and is secured by two clamps *C B* from the top and by side supports *E E*, *F F* and *G*.

Of the two main clamps *C D*, the latter is adapted to slide down over substantial dowel pins after the work is in place, and it is provided with guide bushings for the drills for the holes in lugs *H*. The dowels assure its seating squarely on the tops of the planed lugs *H* in the proper position for the drilling of the holes, and the wing nut allows it to be tightened as hard as desirable or necessary.

INNER SUPPORTS AND CENTERING JAWS

The two side supports *F F* are adjusted against spring pressure, into contact with the inside of the work by means of nurled screw *I* which has a conical point engaging similar surfaces upon the inner ends of rods *F F*, and therefore expanding the rods simultaneously, with the result that the rods center the work sidewise at the same time that they provide inner support for the thin casting walls during the drilling from the sides.

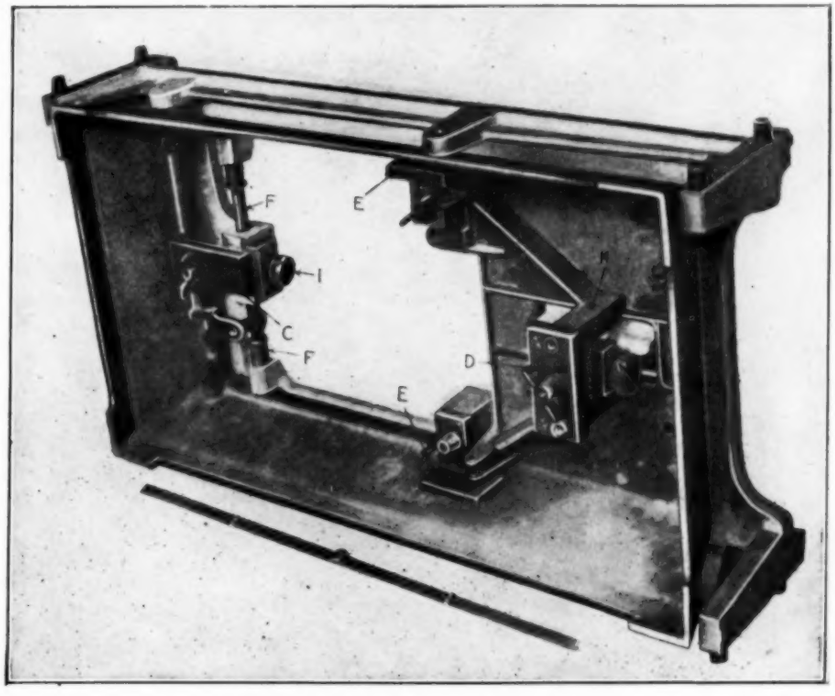


FIG. 4. THE WORK IN THE JIG

Similarly, the other end of the work is centered by means of nurled-head screw *J* which controls a pair of expanding jaws at *G* that act upon the inner faces of the lugs *H H*.

The inner, centering and supporting jaws at *F* and *G* are, of course, adjusted before the top clamps *C* and *D* are tightened upon the work. The inner clamps *E E* are pressed against the side walls of the work and then secured by the wing nuts. The work is then ready for drilling.

The four clamps described and the two pairs of centering and inner supports, are all adjusted in a moment and the drilled casting is as readily removed by reversing the order of operations.

Another Type of Jig

The aluminum jig in Fig. 5 also has some interesting features in the line of locating and centering devices for the castings, Fig. 6. The lid, when closed, is secured by turning two buttons *K K* quarter way around. The work, Fig. 6, is placed upon the supporting plugs shown in the open jig, and is centered in all directions and clamped by the two pairs of equalizing jaws *L* and *M*.

These jaws are operated by rods *N* and *O*, which are threaded right and left hand to fit similar threads tapped through swiveling members like *P P*, which are carried at the outer ends of the jaw levers and cause the jaws to swing in and out when the nurled disks on screws *N* and *O* are turned with the fingers. The nurled disks are fitted in guide slots milled in the ends of the jig, and the threaded rods which they control are thus prevented from moving endwise in either direction.

The jaws *L* are adapted to swivel upon their levers and the sketch, Fig. 7, shows the arrangement and the method of gripping the work by the corners. The jaws being pivoted to permit them to float, they adapt themselves to the form of the corner on the work and the castings are thus held centrally and secured against lateral displacement. The jaws at the other end of the jig, that is, at *M M*, are hollowed out to sieze the castings by the rounded surface near the smaller end. When the jig is closed, the thumb screws in the lid are brought lightly into contact with the top of the work.

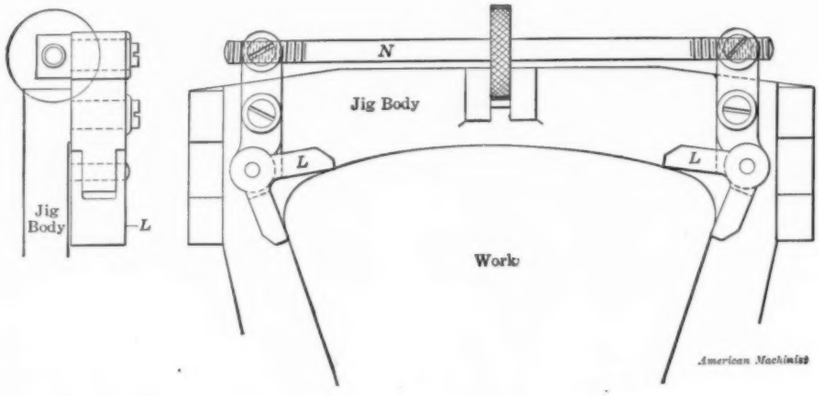


Fig. 6. Equalizing Jaws for Jig

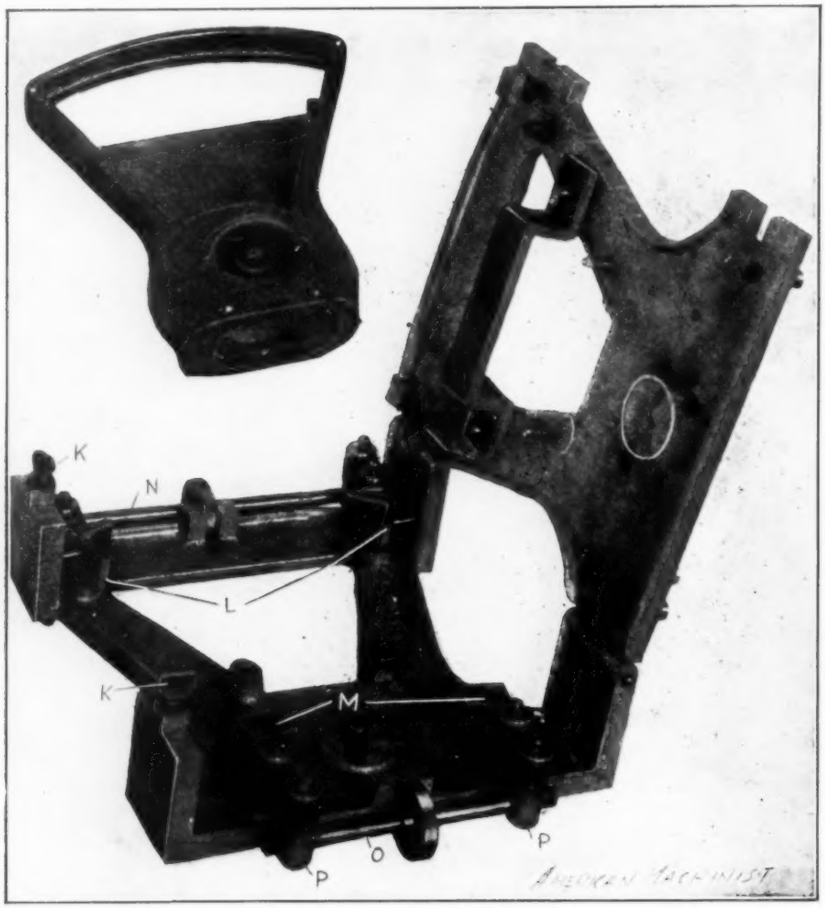


Fig. 5. Construction of the Jig and Work Performed in It

Results of British Compulsory Patent Act

A consular report on the results of the British compulsory working clause of the Patents and Design act of 1907, shows that up to the present 76 applications were made to revoke foreign patents, worked exclusively or mainly outside the United Kingdom. In 55 instances the Comptroller General was convinced that the act had been complied with and the patent adequately worked in the United Kingdom, that where the foreign patentees had not started factories in the United Kingdom they had licensed British manufacturers to work them or had given orders to a British firm to manufacture for them. There were 21 instances where the Comptroller General revoked the patent. The following is a list of the new articles manufactured in the United Kingdom as a result of the compulsory working clause: Metallic-filament electric lamps, aniline dyes, mercerized cotton, safety razors, cinematograph films, talking machines, cash registers, various kinds of shoemaking machinery, oxygen foods and medicines, fancy leather goods and gloves and clay glaze. The new industries are said to be largely as the result of German and American developments.

A Boring Tool of Novel Design

The halftone and line engravings illustrate a boring head that obviously may be used in the engine lathe, turret machine or milling machine, but which the toolmaker will recognize at once as a device particularly adapted for service in the miller for boring holes in jigs, fixtures and other tools.

It will be seen at once, upon inspection of the general view, Fig. 1, that the tool is of an adjustable type, with graduated dial for facilitating minute and accurate settings. A feature not discernible at a glance, but nevertheless, of prime importance, is the incorporation of a differential operating screw by means of which the normal movement of the tool slide of 0.001 inch for each angular advance of one space upon the part of the graduated dial, is transformed at will into an adjustment just one-fifth as coarse, or 0.0002 inch, for each dial movement from one graduation to the next.

Chief Features of Construction

The construction of the tool, external and interior, will be understood from the line engravings, Figs. 2, 3 and 4. The adjustable slide, carrying the boring tool, is shown at *A* in the different views; the body or shank, at *B*; the adjusting screw at *C*. The dovetailed slide *A* is provided with an extension upon the face which is bored and tapered out at the mouth to receive spring collets for holding various sizes of drills and boring tools, and adapted also to receive direct the shanks of tools too large to admit of the use of a holding collet.

The ends of the boring-tool shanks and the inner ends of the collets are slotted crosswise and when in place in the nose of slide *A*, are engaged and held from turning by a tongue on the outer face of a washer *D*, which is doweled in place at the bottom of the chamber. The nurled cap on the threaded nose draws the split collet or the tool securely in place.

Editorial Corespondence

A boring tool of novel character especially adapted for operating on jigs and other special tool work handled on the milling machine. Application of the differential screw principle for obtaining two different adjustments of the boring tool for the same reading on the graduated dial; one of these adjustments reading to thousandths of an inch, the other being much more minute for very accurate and final settings.

Double lipped boring tools used, with suitable means of securing them in place, and applying either lip desired to the work. Simple method of setting the tool by either of the rates of adjustment, according to whether comparatively coarse cuts are to be taken as in getting the hole well bored out toward size, or very fine ones for finishing the hole.

The Differential Screw

The character of the screw for actuating slide *A*, is clearly represented in the sectional views in Figs. 3 and 4, which show the form of thread used and the means of rendering operative either the plain portion of the thread for giving adjustment of the slide in thousandths of an inch, or the combination of threads which for the same degree of rotation impart a movement only one-fifth as coarse to the slide.

The outer end of the screw is provided with a 10-pitch square thread, which fits an internal thread in a lug under the slide and which, in conjunction with the dial graduated in 100 divisions, gives slide *A* a movement of 0.001 inch for each division of the dial. Between this thread and the neck of the screw there is a buttress thread which may be engaged at will by the half-nut *E*. The pitch of this buttress thread is 12½ per inch, representing for each division on the graduated dial, a longitudinal advance of 0.0008 inch. That is, between the movements represented by the two screw threads for any space upon the graduated dial, there is a difference of 0.0002 inch. This possibility of minute adjustment through the difference of the pitches is taken advantage of as follows:

Control of the Screw

The screw *C* is formed with a long neck journaled in the body *B*, and in place of a head or a collar it is provided with a recess which is adapted to be engaged by the two pivoted jaws *F*, that

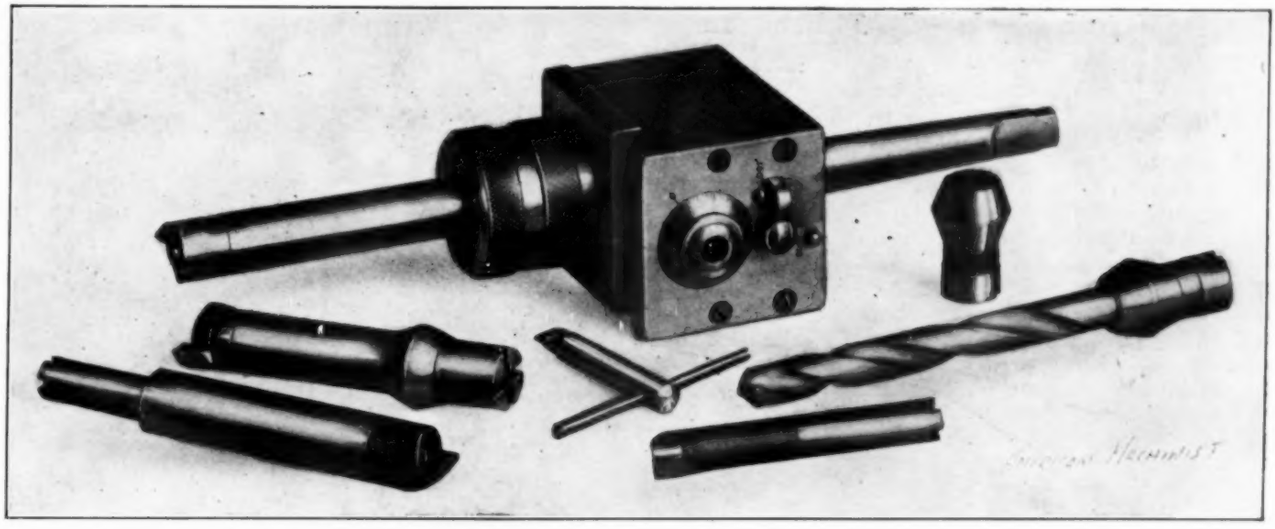


Fig. 1. Boring Head with Chucks and Tools

normally are held apart against spring pressure by an elliptical cam *G*, which is formed near the center of stud *H*. At the inner end of the stud is another cam *I* that serves to hold nut *E* out of engagement with the buttress thread, when the operating stud is turned to the position indicated in Fig. 3. In this position of the stud *H*, cam *G* allows the jaws *F* to engage the channel around the neck of the screw and hold the screw against end movement, so that the 10-pitch thread at the end of the screw is operative and the boring-tool slide may be adjusted by thousandths.

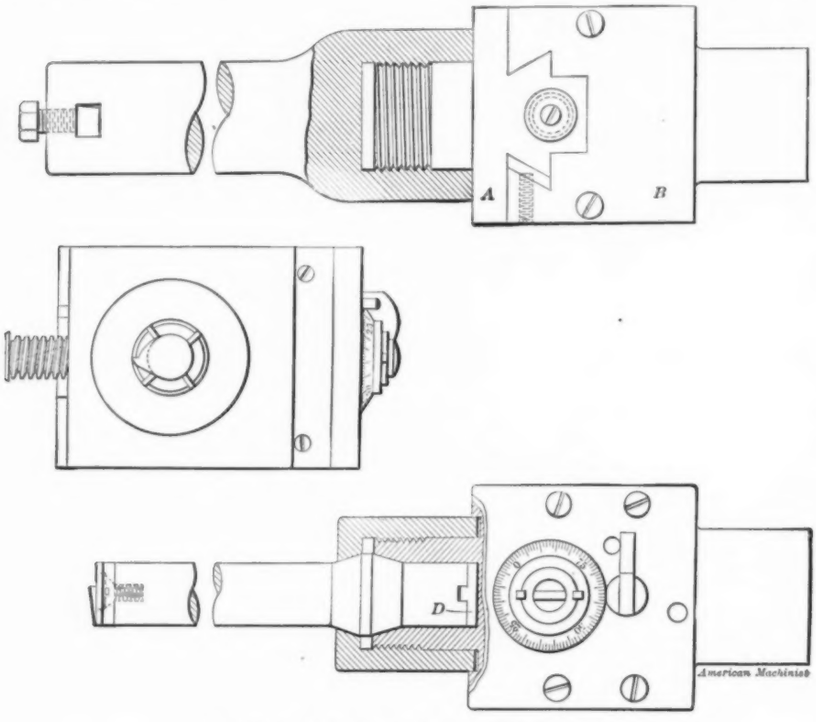


FIG. 2. SIDE AND END VIEWS OF END TOOL

THE FINER ADJUSTMENT

If the operative stud *H* is now turned to the position represented in Fig. 4, cam *G* withdraws retaining jaws *F* from their seat in the groove around the screw *C* and cam *I* at the same time permits the compression spring under half-nut *E* to force that nut into engagement with the buttress thread. A brief consideration of the character of the connection now established by the differential screw *C* between the fixed body *B* and the movable slide *A*, will reveal the fact that upon rotary motion being imparted to the screw the slide must advance or recede at a rate per turn of screw equivalent precisely to the difference between the leads of the two threads upon the screw. For both threads are cut the same hand (in this case left hand), and screw *C* being free to travel endwise will, when rotated to the right, withdraw from the body *B* at the rate of 0.080 inch per revolution (the buttress thread being 12½ threads per inch), while the 10-pitch square thread will, at each turn of the screw, feed the tool slide *A* in the opposite direction a distance equal to 0.100 minus 0.080 inch, or 0.020 inch. Dividing this by 100, the number of graduations on the dial, and we have for each division a movement of the boring-tool slide of 0.0002 inch.

SETTING DETAILS

The stud *H* with its two cams *G* and *I*, is given a quarter turn to set the device for operating with either the simple or the differential screw movement. It is provided, as shown in the halftone, with a thumb piece which swings between two stop pins. The face of the block is stamped opposite the pins, "0.001" and "0.0002," showing the position of the thumb piece for either reading; as set in the halftone, the tool is adjusted for the coarser movement, or 0.001 inch per each division of the dial.

The cylindrical portion of the screw *C* is provided with a keyway to receive a feather in the hub of the dial. The latter has a retaining plate attached to its inner face, as shown in Fig. 3, and the screw while rotating the dial, may at the same time slide through the dial hub without displacing it laterally.

In ordinary usage, this boring head should be set by the coarser of the two methods of adjustment until the hole that is being bored is nearly to size, when the differential principle is brought into action by moving the thumb piece into horizontal position, and the hole is finished by means of the very fine adjustments, with the dial reading to 0.0002 inch.

For actuating the screw a flat-ended key is used which enters a socket formed in the outer end of the screw.

POINTS RELATING TO THE BORING TOOLS

Several boring tools are included in the view presented in Fig. 1, and it will be noticed that these cutting tools are themselves of an interesting character. The working end of the tool consists of a short piece of steel in the form of a shell and provided with two well cleared cutting lips. The shell fits a pilot on the end of the cylindrical shank, and is retained upon the shank by a small screw applied from the end. Ordinarily, this type of tool would be used with the boring head set off center and with only one lip in cutting action. It is, therefore, an easy matter, where desired, to utilize one lip of the tool for roughing, turn

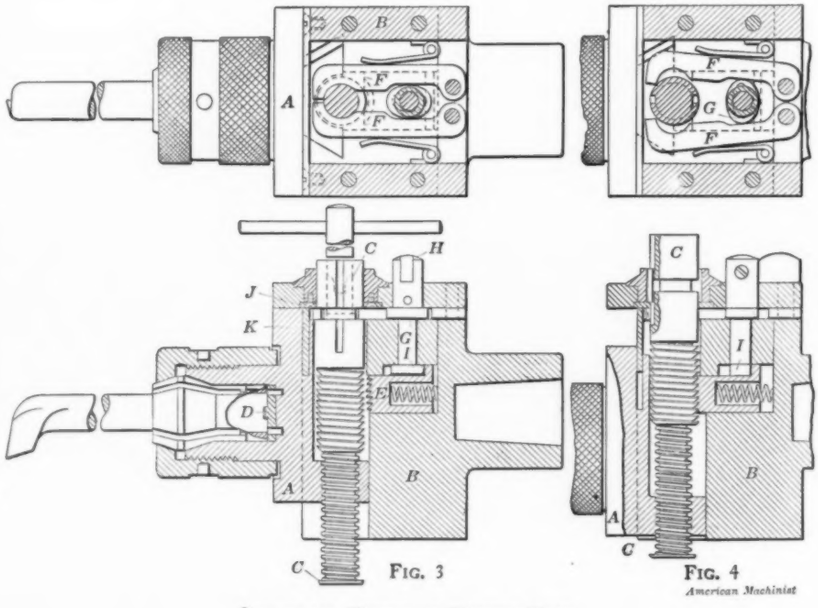


FIG. 3 FIG. 4

SECTIONAL VIEWS OF BORING TOOL

the shank half-way round in the chuck and bring the other edge of the tool into service for finishing cuts.

Where the small diameter of the hole does not permit a boring tool of this type to be applied, a regular tool with point upset, as shown in the foreground of Fig. 1, may be used. The boring tool referred to is milled across the rear and to provide the two driving notches which are engaged by the tongued disk *D* at the bottom of the chuck recess, Fig. 3.

Where it is desired to use a drill in the boring head, the appliance is, of course, set central; that is, the slide is drawn back into contact with cover plate *J*, as indicated by Fig. 3.

Protection from Chips, Etc.

In order to prevent chips from entering the head when the slide *A* is moved away from the cover plate *J*, as in Fig. 4, a lining plate *K* is attached by small screws to cover the opening in body *B*, this plate fitting into a slot milled in the edge of slide *A*, as represented.

The inventor and patentee of this ingeniously designed boring appliance is Adolph Muehlmatt, Lion building, Cincinnati, Ohio.

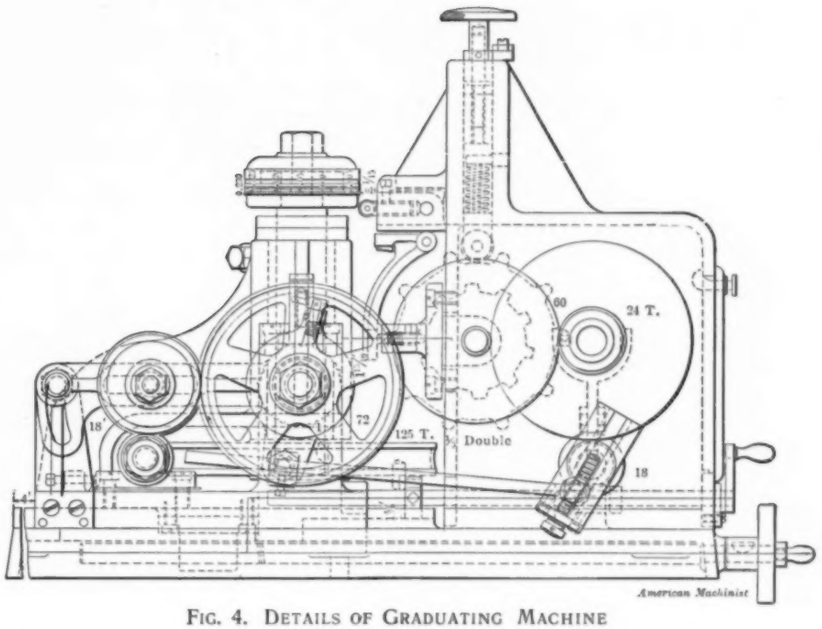


Fig. 4. Details of Graduating Machine

A Collar Graduating Machine

A sound, compact machine is the one made by the Bullard Machine Tool Company, Bridgeport, Conn., for graduating the collars used on the feed screws of their boring mills and vertical turret lathes.

Fig. 1 shows the machine from the driving-pulley side, and Fig. 2 gives a view of the other side. *A* is a graduated collar which is indexed for the graduations by an intermittent motion given the worm wheel on the lower end of the spindle, through a worm and gears *B*, *C* and *D*, which are operated by the rod *E* acting on a ratchet wheel mounted on the same shaft as gear *B*. The number of graduations to be cut may be varied by changing the gears *B* or *D*, *C* being merely an idler, or by changing the stroke of the rod *E* through adjustment of the crank *F*, by means of the thumb screws *G* and *H*. The carriage carrying the collar and indexing mechanism may be moved out or in, so as to adapt different-sized collars relative to the graduating tool, by means of the handle *I*, which turns a screw running in a nut in the base of the carriage.

Fig. 3 is an enlarged view of the tool, tool slide and cams. *A* is the graduating tool which, it will be noted, is a disk which rolls instead of cutting in the lines; *B* is the tool block, pivoted at *C*; *D* is the tool slide or carriage which is given its movement through the roller *E* and cam wheel *F*. This cam wheel has 10 teeth, the fifth one being longer than the previous four and the tenth one longer than the fifth one, which gives the length of graduated lines shown on the collar. At *G* and *H* are shown two of the teeth of another cam wheel which operates the tool-relief lever *I*, the operation of which will be more clearly understood by reference to Fig. 4.

In a paper presented at the Detroit Convention of the American Brass Founders dealing with magnesium as a as a deoxidizing agent in aluminum alloys it was pointed out that in making alloys it is a common experience to find at the first melting a metal which has been added will not be thoroughly incorporated with the alloy, and it is only after the second melting that the different ingredients blend together thoroughly. Then, too, the addition of a strange metal to a combination does not seem to form a homogeneous alloy at first, but if the main body of the metal already contains some of the metal to be added, the blending seems to take place more rapidly and more uniformly.

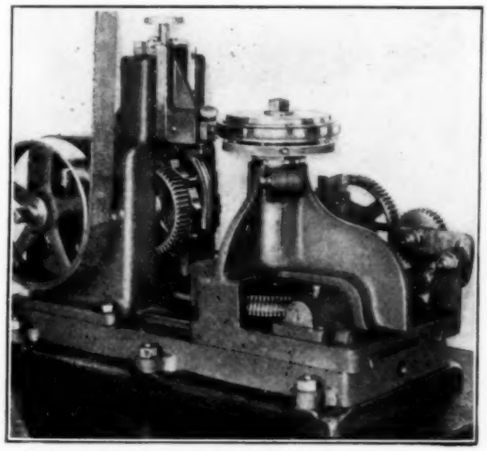


Fig. 1. Graduating Machine from Power Side

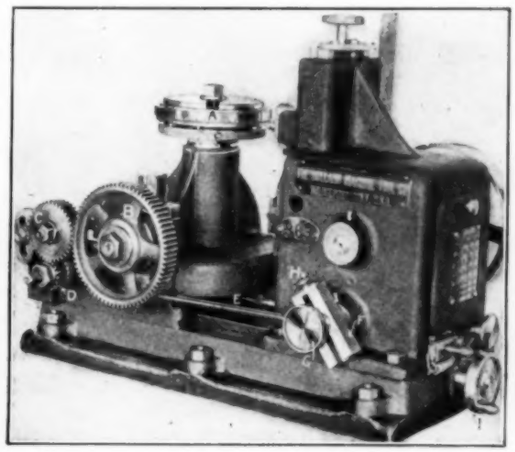


Fig. 2. Gearing, Connecting Rod and Adjusting Crank

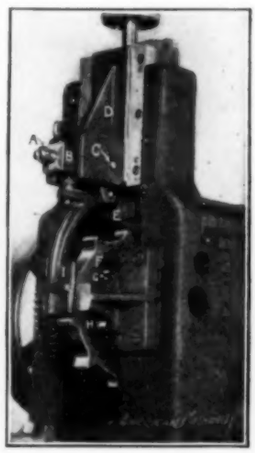


Fig. 3. Graduating Tool and Cams

Automatic for Commutator Segments

An automatic assembling machine of German manufacture embodying ingenious mechanism.

The Deutsche Elektrizitats-Werke, zu Aachen—Garbe, Lahmeyer & Co.—Aktiengesellschaft, build an automatic machine for performing several operations on commutator segments; performing on this one machine work that formerly required considerable hand labor and the use of several ordinary machine tools. Many interesting mechanical principles and devices are used in the construction and automatic action of this machine.

Fig. 1 shows the machine itself fitted with a self-contained motor drive. Fig. 2 shows the parts of the commutator segments and finished product as assembled in this machine. But little attention is needed, except to keep the hopper filled with parts that form the raw material for the machine's operation and to take away the finished product.

The devices for feeding and assembling the segment and its contact strip are shown in the accompanying line engravings.

Sorting Device for the Segments

This device is arranged on an inclined slide directly behind the first magazine,

Fig. 2. Segment Blank at Left, Contact Strip in Center, Assembled Segment at Right

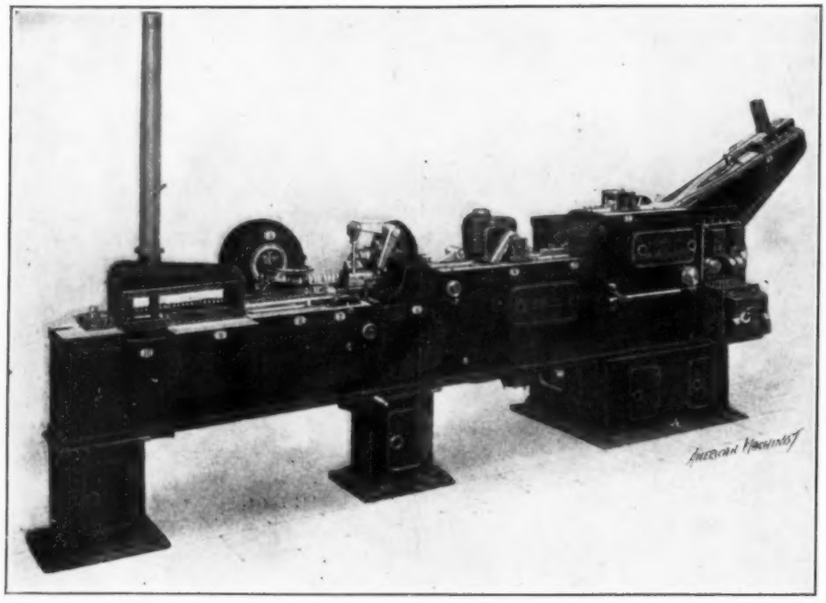


Fig. 1. Commutator Segment-assembling Machine

into which the segments are poured in bulk. Here they are so arranged that they leave the magazine with the thicker edge of the segments always lying toward the same side. To accomplish this result the segments are controlled by two guides, so that they are centered over a V-shaped knife edge. See Fig. 3. Because of the thicker edge the center of gravity of the segments will fall on one side or the other of this knife-edged strip, according to whatever position they may be in originally.

Since, however, one side of the knife edge is perpendicular to the slide, and the other is a sloping concave surface, the falling segment in the first case turns over so that it revolves 180 degrees; while in the latter case it slides down the inclined curved surface and does not turn over. Hence on the slide, after the knife edges have been passed, all of the segments lie with their heavier edges pointing in the same direction.

Controlling Device for the Segments Feed

Fig. 4 shows controlling device for the feed. The slide *A* at the extreme right of the illustration, with the lug *B*, pulls the segments out of the first magazine, one at a time. The reciprocating motion of the slide is taken from the pull rod *C*, driven by a crank and lever transmission. The latch *D* pivoted on one end of the rod *E*, which is fixed to the slide *A*, is made to engage a dog on the pull rod *C* by means of a spring, and thus provides a releasable connection with the slide *A*.

In operation the segments come from the above mentioned first magazine over the inclined slide and along a chain conveyer to the small second magazine *Z* where they collect and from whence they supply the slot-milling device. (This magazine is necessary since the crooked segments are separated out in advance.)

A stop pin *P* enters the magazine *Z* periodically; this pin is carried on a double-armed lever *F*. This lever carries at its other end a stud *G* which engages in the fork *H*, fixed to the revolvable rod *I*, which rod reaches back to the arm *K*. This arm is engaged with a slide *L* and is held by a spring *M* and stop pin *N*, which acts upon the fork *K* in such a manner that the notch of the slide *L* lets the latch *D* pass unhindered. The bell crank *O*, whose pivot lies in line with the center of the stud *G*, has a periodic oscillating motion, produced by an eccentric on an operating shaft (the two latter parts are not shown in the sketch). This oscillating movement is communicated to the lever *F*, whose pivot is on one arm of the bell crank *O*.

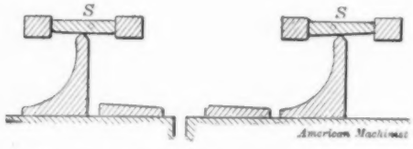


Fig. 3. Segment-sorting Device

During this motion the stud *G* does not change its position so long as the pin *P* moves unhindered. So soon, however, as sufficient segments have accumulated in the second magazine, the pin *P* strikes against them. In consequence the lever *F* has a movement with respect to the bell crank *O*. This motion is transmitted to the fork *H*, the rod *I* and arm *K*, so that the position of the notch in the slide *L* is changed, and the latch *D* strikes against the slide *L*,

whereby the connection between the rods *E* and *C* is released, and the slide *A* remains in its outward position until the pin *P* again finds its path unhindered. The arm *K* is not keyed fast to the shaft, but is connected by a tension spring and a stop, which are not shown in the sketch.

Thus a contact strip in the position *F* is knocked off the belt *D*, while the pin in the position A_1 merely rides over the strips indicated at *G*. In the outward motion the pin pushes the strips that are in the position *G* along the belt to the operating tools.

If the belt is completely loaded with contact strips the spring *H* can no longer completely execute its motion. In this case the pin remains in the position A_2, and knocks all of the strips from the belt *C* back into the drum until such time as strips can be advanced once more along *D*.

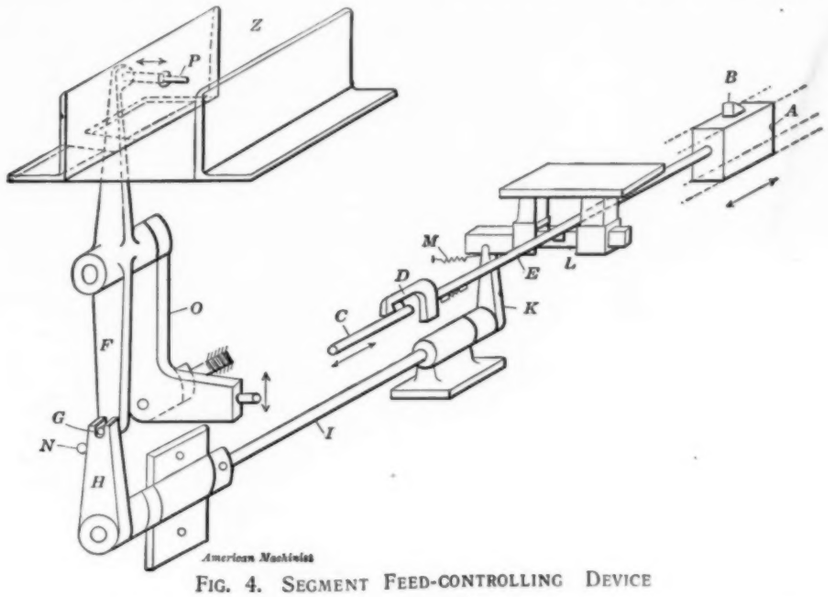


FIG. 4. SEGMENT FEED-CONTROLLING DEVICE

THE CHUCKING HEAD

This device is shown in the line engraving, Fig. 5. It is a vise that holds the segments during the slot milling operation. For this purpose the segment is clamped tightly between the swinging jaw *A*, provided with two locating guides, and the swinging jaw *B*, which is in the slide. The clamping is done through the regulating screw *G*. Meanwhile the springs *H* at the sides are compressed.

REGISTERING DEVICE FOR THE CONTACT STRIPS

This device is shown in Fig. 6, where the contact strips are dumped into the hopper *L*, led to the slowly revolving drum *B*, whose lugs carry them along in direction of rotation until coming over the inclined surface of the drum they either drop back or are taken up by the steel belt *D*. A shaking motion of this belt throws off such strips as stick together and there remains only those that are riding on the belt, held by their shanks. Those marked *G* in the illustration are in a proper position to be later inserted into the segments. Those in a position marked *F* must be reversed. The former are carried along by means of a pin *A*, which in addition to a periodic reciprocating movement over the belt *D*, varies its distance from the belt in such a manner that on the outward movement, under control of the curved arm and spring *H*, it assumes a position close to the belt *D*; while on the return movement it occupies a position somewhat above the belt *D* as shown by *A*.

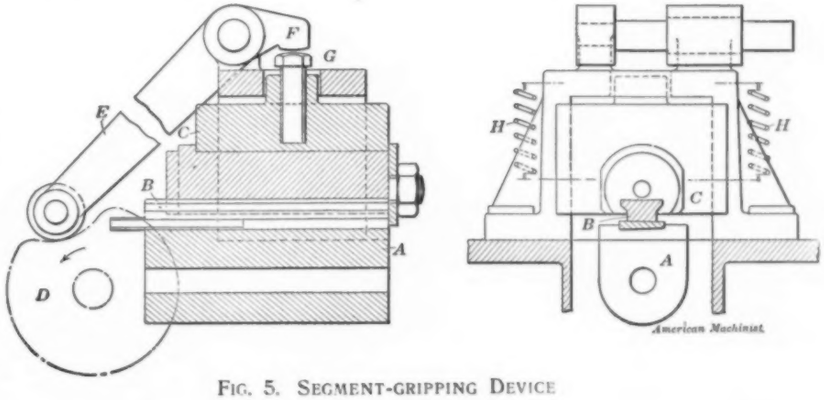


FIG. 5. SEGMENT-GRIPPING DEVICE

RIVETING DEVICE

After the contact strips have passed into the operating tools and been pushed into the segments, the riveting device, Fig. 7, makes deep impressions in the segments and strips and presses them firmly together. The control of the ten-ton eccentric press is through a stop pin which has the same method of operation as the pin *P* of the segment feed regulator. The press is so arranged that it can only begin to operate when the pin strikes against a contact strip correctly set in a segment. Otherwise the lever closes a weak current circuit, which alarms the operator by a single bell and causes a removal of the imperfect segment or strip through a special passage.

The driving motor is automatically stopped by a weaker relay, which acts, if through failure of the control, the periods of work and feed, which must follow each other, occur simultaneously. The general dimensions of the segments that the machine is capable of handling range in length from 2½ to 5¼ inches, in width from ¾ to 1¼ inches, and in thickness from 1/16 to ¼ inch.

Claims of Efficiency That Are Hard to Prove

BY JOHN R. GODFREY

It is very much easier to make claims than to prove them. Mr. Emerson allows his friends to claim that he saved over $5,000,000 in three years on the Santa Fe system and yet their annual reports for these years do not show any considerable saving in repairs over previous years.

Comparisons are difficult because conditions of various railroads vary greatly just as do other shop conditions. The age of the rolling stock and of the tool equipment, the physical characteristics of the road as to curves and grades all play their part. Some cite $37 per car as a

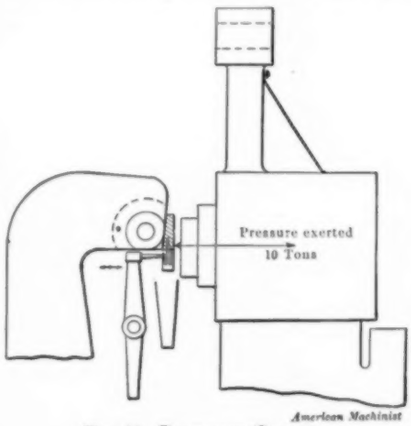


FIG. 7. RIVETING DEVICE

unit for freight-car repairs per year, while other roads vary from $31 to $100. And there may be a reason for each.

But there seems to be good evidence that all of the standards selected for the Santa Fe were not evolved out of the inner consciousness of the improvers, but were taken from the practice of the Chicago & Northwestern railroad where they were introduced by Mr. Quayle, one of the best shop managers in existence. And these standards came into being without time study, piece work or other of the absolute essentials according to the statements of the new crop of efficiency engineers.

Percentages are apt to be very misleading. A shop employing two men increases its force 50 per cent. by taking on an extra man, while a similar increase in men, in a shop employing 100 men would not indicate a very remarkable increase in business. In the same way comparisons in the percentage of saving effected are not at all convincing until we know the conditions both before and after taking the efficiency tonic.

There are many cases where we can save 50 per cent. of the former cost and then, just as we get ready to pat ourselves on the back, to find that some other shop is doing the work for much less than we are, with all our improvements. It is so easy to criticize others and to fool ourselves that we all do it more often than we realize.

A Personal Experience

Years ago the writer took a job as a general improver, with a roving commission all over the shop; a sort of efficiency engineer, only he didn't know it. And he can truthfully say without undue elation or self-glorification, that he saved more per cent. than he ever expects to see outside of a mining prospectus.

And, much as he dislikes to admit, it was not because of excessive brilliancy on his part, but because of the unlimited opportunity that he found awaiting him. The nearest approach to jig or fixture was a single manilla paper templet for the holes in a pipe flange. There was hardly a method in the shop that could not have been improved by a bright apprentice boy, which gave an opportunity that is seldom found. One jig reduced the time on an important piece from 4½ hours to 15 minutes, and there were many others of a similar nature.

At the present time, with our modern advanced view of advertising or the more subtle publicity, I should probably be invited to speak at three banquets a week, and between the puffs of the other fellow's cigar, tell him what an ignoramus he was and point out the possibilities of saving 500 per cent. in almost any old line of work.

I seemed to have lived too early in the game and to have missed the title that opens the way to fame, good dinners and advertising without cost.

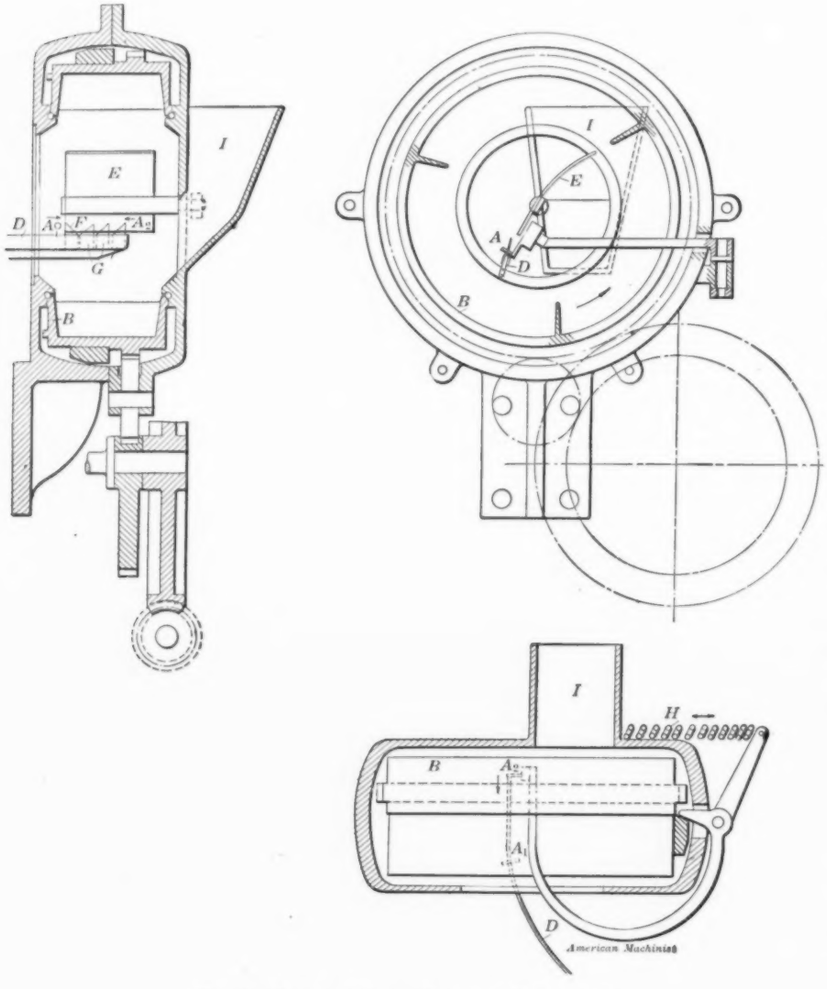


Fig. 6. Contact Strip Feeding Mechanism

Double Spindle Machines

We sometimes go astray on the question of double or multiple machines for special work. Many times they work out in fine shape and increase production in a way that makes the pocketbook take on a smile of gladness. But there are other times when it has the opposite result and it presents a flatness that can be felt.

A case in mind is a certain type of grinder, where the purchaser was sure that a multiple-spindle machine would multiply his outfit many fold, while the maker was equally sure that the results would not be satisfactory. And he seemed to have the best of the argument.

The double machine would cost twice as much as the other because it would be special and not very many of the standard parts could be used. But the output would not be doubled for a number of reasons.

And here's why:

Both spindles would have to stop when a piece of work was being changed.

The wheels would not wear alike and one would probably require resetting oftener than the other, both being tied up during this operation.

These would reduce the output far below that which could be secured with two separate machines, both of which could be handled by the same operator just the same as the double machine.

It is another of the cases where the simpler machine will win out in practical work in spite of the apparent saving by the doubling of the spindles.

John H. Cooper, in Volume XIV, of the *Transactions* of the American Society of Mechanical Engineers, stated: "Inscribed upon an ancient crest of a pick ax are the trenchant words, 'Either I will find a way or make one.' A good motto for an engineer, but his work is not done till he publishes how he did it." The last statement is as forcefully true today as it was 20 years ago when first spoken.

Better Output from the Same Tools

By Henry M. Wood *

Attention to details of machine foundations, methods of leveling and general care of the machine tools necessary if maximum efficiency is to be obtained. In setting up, suitable metal wedges are desirable, and a precision level should be employed.

How planers and lathes are leveled lengthwise and crosswise; and how they are kept in proper alinement by tests at regular and frequent intervals.

The importance of cleanliness in the shop, and of attention to proper lubrication of machines and countershafts.

There are many opportunities, even among the well organized shops, to greatly increase the efficiency of the machine tools by attention to a few details. Proper care of this equipment will be well repaid by the better grade of work produced and by the increased life of the machines themselves; at the same time the costly delays for overhauling and repairing machinery will be much reduced.

Machine-tool builders are often unjustly accused of sending out inaccurate machines when, in reality, the trouble is due merely to lack of care on the part of the user. In other cases, the user never even realizes that the output of his machine tools is not up to standard.

Solid Foundation Necessary

There is considerable argument as to whether concrete or wood floors are preferable in the machine shop. Each has its advantages for certain conditions, but as a base for heavy machine tools the concrete floor is preferable because it is practically unyielding.

If it is necessary to place heavy machinery in a shop having a wooden floor, it is well (if on the ground floor) to cut away the boards and fill with concrete just where the machine is to stand. This can be easily done whether the wooden floor is laid directly on the ground or whether the boards are laid over concrete.

A little extra investment to secure a rigid foundation will prove to be money well spent, as a shaky foundation would make leveling very difficult and would cause unnecessary vibration of the machine itself.

Why a Machine Must Be Level

Too many managers do not understand that even a stiffly braced bed will not remain true if it is out of level. But it is a demonstrated fact that no matter what the type of machine and no matter how massive the bed, it must be level to do its best work.

A manufacturer of radial drills recently had a complaint that one of his new machines would not drill square with the base. Unfortunately he accepted his customer's statement that the machine was properly leveled, and ordered the machine back without sending his own man to investigate. After setting the machine up on the testing floor and carefully leveling the base, it was found to be well within the limit of accuracy allowed.

We have occasional complaints that a lathe will not bore or turn true. In such cases we almost invariably find that as soon as the bed is carefully leveled the difficulty entirely disappears. Other troubles caused by a lathe being out of level are that the carriage binds at certain points of travel along the bed; that the

*With the Lodge & Shipley Machine Tool Company.

Fig. 1 Medium-sized Lathes Leveled with Solid-iron Wedges

spindle will not have proper bearing in its boxes, and cannot revolve freely.

Similar incidents might be cited regarding other machines. And in every case not only the quality of the output, but the life of the machine itself, is lessened by the tool being out of level.

How to Level Machine Tools

A precision level is absolutely necessary in setting up machine tools. A carpenter's level will not answer at all for this purpose. A carpenter's level might indicate that a machine was properly set, when in reality it was so badly off that if a sensitive level were used the bubble would be entirely out of sight.

Another requirement is wedging material that will be reasonably permanent. Wooden wedges shrink in dry air, and swell if a little oil or water drips on them —for these reasons they are not suited to most cases. Good-sized iron wedges are quite satisfactory for light- and medium-weight machines. Fig. 1 shows the lathe department of the Lodge & Shipley Machine Tool Company where medium-sized lathes are placed on solid wrought-iron wedges on a wooden floor. This combination works to good advantage.

For heavy machines, special cast-iron leveling blocks with screw adjustment are best. In the Lodge & Shipley planer department, illustrated in Fig. 2, such leveling blocks can be seen let into the concrete floor at the four corners of each bed and at intervals along the sides of the beds. The top part of the block, on which the bed directly rests, is movable by means of an adjusting screw along the inclined upper surface of the base, thus providing an easy means of raising and lowering the bed wherever desired.

Using the Level on Planers and Lathes

Every planer should be very accurately leveled lengthwise and crosswise. This can best be done if the table is removed. Two carefully ground cylinders or rolls are needed, which are placed in the V's of the bed. A straightedge is laid across the tops of these rolls, with the level on top of the straightedge. The rolls can be made of either steel or cast iron; they must be perfectly straight, both of exactly the same diameter, and large enough that when laid in the V's the top of the rolls will be higher than the top of the V's. The straightedge must be long enough to reach from center to center of the V's when leveling the bed crosswise. The bottom of the straightedge which rests on the rolls, and the top on which the level is placed, must be scraped perfectly parallel. First level the bed lengthwise at the center, by placing both rolls first in one V then in the other, and about as far apart as the length of the straightedge. Next the bed can be leveled crosswise at the center, then lengthwise and crosswise working toward each end.

In the case of a lathe, the machine should first be leveled lengthwise by placing the level on the flat way of the bed parallel to the V's. To level crosswise, place the level upon a straight-edge which rests across the front and rear wings of the carriage at right angles to the V's. Move the carriage along the bed, and see that it shows level at all points. Never bolt a machine solidly to the floor unless it has first been leveled.

No matter how well leveled any machine tool may be when first set up, and no matter how solid the foundation on which it rests, it cannot be left without further attention. In our plant there is a shop rule requiring every department foreman to remain the first Saturday afternoon of each month and personally see to it that each machine in his department is perfectly level. It is evident that a very slight settling of the foundation, a small slipping of the wedges, or a trifling stretching of the metal in the bed itself due to the constant shock and vibration of cutting, would throw the bed out of exact level. Therefore a careful inspection of the leveling of all machine tools is necessary once a month in order to keep the output up to the best standard of quality.

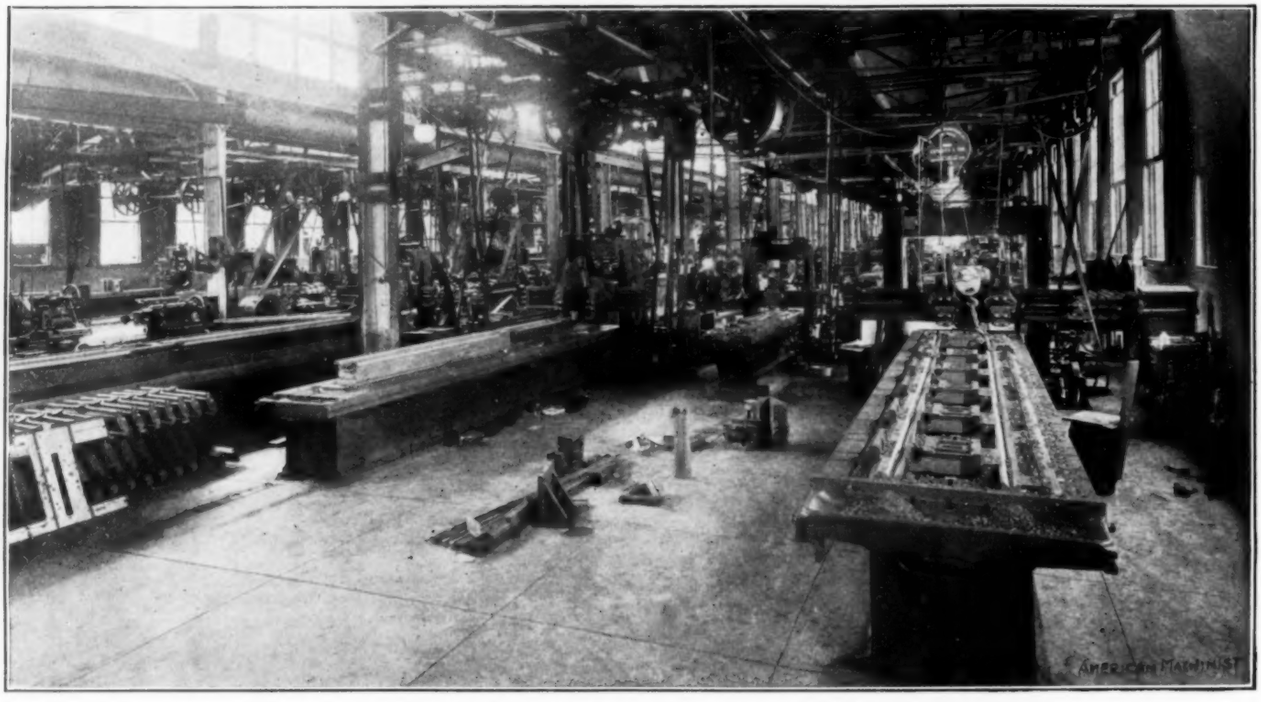


Fig. 2. Planers Resting on Leveling Blocks

Cleanliness in the Machine Shop

To preserve the alinement of a machine it is also necessary that all slides and bearing surfaces be kept clean and free from grit. When turning cast iron the operator should frequently wipe off and oil the ways of the lathe; if these chips are allowed to accumulate on the ways and work in under the carriage the machine will soon be out of commission for overhauling. When planing a long job extending nearly to the end of the table, an extension board should be added to prevent any chips falling into the V's of the bed. The life and accuracy of machine tools depend upon keeping dirt out of all bearings.

Figs. 1 and 2 also show what is easily

possible in the way of keeping all machines, and shop floors as well, scrupulously clean. These views do not show special Sunday clean-ups, but are from photographs made at noon hour during a regular working day.

We have certain laborers whose duty it is to *continually* sweep up—in other words, *keep* the shop clean instead of *get* it clean once in a while. To other men is assigned the work of emptying the chip pans under the machines. Each operator is largely depended upon to keep his own machine clean and free from chips. In addition there is a general cleaning-up each Saturday afternoon by one or two men in each department who wipe up each machine thoroughly and go over the finished surfaces with oily rags.

Oiling Machines and Countershafts

The mere fact that a countershaft is located on the ceiling usually results in its being subjected to neglect and hard usage. Too often the countershaft is not even properly lined up when originally hung; it should be set level, exactly parallel with the line shaft, and should run perfectly free before being belted up. The oiling of all countershafts and line shafts may well be left in charge of one man in each department, who is held responsible for their care. Some countershafts are lubricated by compression grease cups, which should be filled with a good quality of heavy grease. If, as is more usual, machine oil is required, use the best mineral oil and select a moderately heavy oil so that it will have sufficient body to prevent its being forced out of the bearings.

Ample lubrication of all machine-tool bearings is more necessary now than ever before. The higher speeds, deeper cuts and coarser feeds of today mean much greater pressures on the journals than were known a few years ago. Cases of journals seizing as a result of nothing but lack of proper lubrication are all too common. In view of these facts it seems desirable either to fit all principal bearings with sight-feed oil cups, which will show at a glance when they require refilling, or else to make the bearings self oiling. When a bearing is thus arranged so that it is continuously flooded with oil, a lighter oil should be used than where the lubrication is only at infrequent intervals.

Drill-Feeds—Following Up Piece Operation Records

By R. W. Hargrave

The following up of piece-operation records led to a study of the efficiencies of certain drillers with interesting results.

There was found to be on different machines doing the same class of work a wide difference in maximum drill feeds. These maximum feeds varied from 0.005 inch to 0.039 inch per revolution of the drill. The 0.005 inch per revolution was too slow for practically all the work being done on these machines and the fineness of this feed was aggravated by the fact that the feed mechanism slipped badly when put in use on work requiring any considerable pressure to force the drill into the cut. The highest machine speed being about 260 revolutions per minute, the machine could not be speeded up to make up for the slow feed on much of the work being done.

When these conditions were known it was not surprising that uniform results could not be obtained.

It would seem that the fact that conditions of this kind, under old systems, can continue for years without being brought to light is worth consideration.

To design new feed mechanism for the machines appeared to be the best solution of the difficulty. Practically all of the drilling upon these machines ranged from holes ¼ to 1½ inches diameter. Both machine steel and cast iron were drilled.

Conditions limited the changes of feed to four and the question of what these feeds should be to give the best all-day efficiency per machine at once presented itself.

Various Considerations

Experience had shown that with the old-style driller, which, of course, these were, it was impossible to make full use of the capacities of high-speed steel drills except for a very limited range of sizes. For the smaller sizes lack of speed and for the larger sizes lack of power limited the output. The difficulty due to lack of speed could to some extent be counterbalanced by increased feed if it could be obtained.

When drilling a given material, the feed which may be used depends, within certain limits, more upon other conditions than upon the size of the drill.

The spring of the machine, the spring of the work, the spring of the jig and the requirements of accuracy all have their effects. The matter of spring has a very decided effect in long holes and where holes are drilled through the work. Experience shows that a ⅜-inch high-speed drill can be run day after day, in regular practice, drilling cast iron with a feed of 0.02 inch per revolution and a speed of 360 revolutions per minute (this was the highest speed obtainable on the machine in use) where the drill did not go through the piece. When the drill cut through the piece there was strong liability of drill breakage due apparently to the increased feed caused by the released pressure as the point of the drill broke through.

If as coarse feed as 0.02 inch per revolution can be used upon a drill as small as ⅜ inch in diameter then the minimum feed must be determined by other conditions than the size of the drill to be used. Minimum output should be as large as possible and as minimum feed is a large factor in determining this output it should be made as large as is practical. The question of the accuracy of the hole and the alinement of holes in certain classes of work was largely the determining factor of the minimum feed in this case.

Another factor in determining this minimum feed was that it seemed desirable, as an assistance to the foreman, to adhere as nearly as possible to some standard set of feeds for this class of work. In this connection it was also thought desirable to arrange the feeds so that the feed which was in use was instantly visible even from some distance from the machine.

A feed of 0.008 inch per revolution of the drill was deemed to be about as coarse as it would be advisable to use on some work and as there were other machines for similar work, which were giving good satisfaction with feeds of 0.008, 0.012, 0.016, 0.022 inch per turn of drill, it was decided to adopt these feeds.

It will be noted that the previous maximum feed on these machines has been increased over 50 per cent. by the new minimum feed, to say nothing of the previous slipping of the feed mechanism. The new feed is geared.

It is interesting to note that the 1¼-inch carbon steel drill when following a ⅝-inch drilled hole, gave nearly as good satisfaction as regards life of drill and length of time between sharpenings when running at 120 revolutions per minute; that is, about 47 feet per minute, and a feed of 0.0334 inch per revolution, as it did when run at 67 revolutions per minute and a feed of 0.008 inch per revolution. An attempt to use this drill at 120 revolutions per minute when cutting from the solid resulted in its rapid burning.

In this work I noted conditions which I have never seen discussed in this connection, at least under this heading—the effect of suggestion made by the machine itself. This was first brought to my notice in this manner: Two similar drillers of different makes were set close together. They were used on the same class of work, often the same piece passing from one machine to the other. These machines had the following ranges of feeds in inch per revolution of the drill.

Machine *A*	Machine *B*
0.0077 inch	0.0086 inch
0.0115 inch	0.012 inch
0.0154 inch	
0.0212 inch	

Machine *A* was run a large share of the time on feeds 0.0154 and 0.0212 inch per revolution, while machine *B* was run quite universally on feed 0.0086 inch per revolution. Upon inquiry the statement was made that machine *B* had so much faster feeds than machine *A* that it was unwise to use the highest, and my at-

tention was called to the speed of the *feed handwheel.*

The feed handwheel on machine *B* was speeded to a much higher rate than on the other machine and it appeared to be a clear case of where the suggestion offered by the speed of this handwheel was unwittingly being used to limit the feed.

Since that time I have noted in a number of cases the effect upon the output of the involuntary acceptance of machine suggestion.

The persistence of the effect of the suggestion is in some cases very strong and its effect upon output considerable.

The Humphris System of Gearing

By E. M. LeFlufy *

A new system of pin-and-hole gearing generated with proper curves to secure constant angular velocity, and with the other advantages of correctly designed teeth; also advantages of coarse pitch without undercutting, giving strength. Possibility of deeply case-hardening pinion teeth.

*Works manager of the Humphris Patent Gear Company, Ltd., Eastleigh, Hants, Eng.

This system of gearing was first conceived by the inventor in the year 1885. He set himself the task of evolving a type of toothed gear in which the disadvantages of weakness, backlash and inefficiency, due to misalinement or wear of bearings, would be practically eliminated, and which in addition should possess an efficiency not only greater than that of ordinary gears, but which should not diminish as the result of wear.

Considering the case of a pair of ordinary spur wheels, mounted on parallel shafts, it is clear that the region of pressure between two engaging teeth, extends across each tooth from one side of the wheel to the other; and the line of contact varies in its position from the point of each tooth to its basal region, according to the position of engagement. If, however, the bearings become worn, the wheels are no longer parallel and the tooth pressure is then concentrated upon one side of the wheel instead of being distributed over the full width of each tooth. During certain positions of tooth engagement, therefore, the pressure becomes concentrated upon one corner of each tooth. Thus the strength supposed to be derived from the width of the tooth is to a large extent lost, as the pressure and shock come all on one side.

The effect of wear of bearings on the alinement and tooth engagement of bevel gears is still more serious. This is because of the relative position of the bearings of the shafts at right angles; any wear at all in the bearings results directly in throwing all the load upon the outer corners of the teeth.

To eliminate the bad effects of misalinement, it was apparent almost from the start that one of the engaging surfaces should be of circular section. Not only was it necessary to establish a form of tooth which would overcome the faults of misalinement, but in addition the necessity of evolving a cheap and accurate method of manufacturing the teeth had to be devised. The result, after much experiment, spread over a period of nearly three years at the company's factory at Eastleigh, Hants, England, is the Humphris tooth-and-hole gear, which is here described and illustrated.

Referring to the accompanying illustrations, it will be seen that the system of this gear consists of engaging accurately formed teeth in circular holes of corresponding proportionate dimensions, the shape of the curves being chosen with a view to eliminate backlash and insure constant angular velocity of the geared wheels.

Turning to the sections shown in Fig. 4, which represent six successive positions of a tooth engaging with a hole, it will be noticed that, although the section through the centers of the teeth and holes shows an apparently small thickness of metal between consecutive holes, these partitions are in fact very strong, as the section reveals only what might be described as the crown of a double

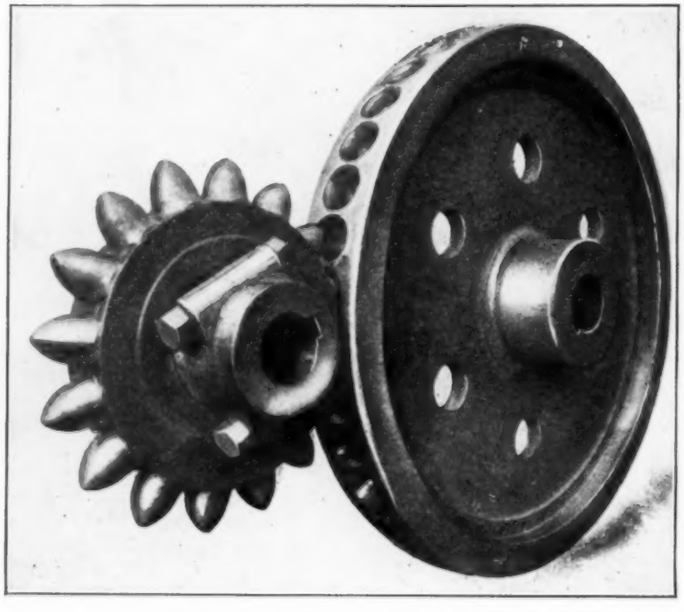


FIG 1. HUMPHRIS TOOTH-AND-HOLE GEAR WHEELS

FIG. 2. DOUBLE-TOOTH WHEELS AND SEGMENT WITH LINED HOLES

arch. Thus the difficulty which is encountered in designing the ordinary straight teeth of large pitch and small pitch diameter, without their being weakened by undercutting, is entirely avoided. The thickness of the Humphris tooth is about 0.7 of the circular pitch and the minimum section of the metal between the two holes is about 0.3 of the pitch, a ratio which gives comparatively small average angle of obliquity to the direction of tooth pressure.

Further, the position of the pitch point is about one quarter of the tooth hight from the base, so that the major portion of the tooth is addendum. Consequently

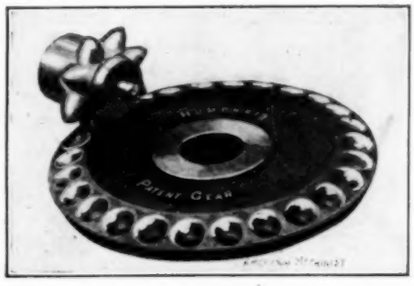


FIG. 3. BEVEL WHEELS

FIG. 4. DIAGRAM OF TOOTH ENGAGEMENT

the arc of approach is very small, and the engagement during approach almost pure rolling contact.

Referring to Fig. 4, and following the tooth *A* during its six consecutive engagement positions, it will be seen that the surfaces have a large radius of curvature, that the action during approach is almost pure rolling, and that when slip takes place during recess, as it must do in any form of tooth, the curves of the Humphris tooth and hole conform, instead of opposing one another. In other words, the centers of curvature are on the same side of the contact region. This increase of curve contact during slip reduces the intensity of tooth pressure, and the lubricant used is not forced off the touching surfaces.

Owing to the fact that the surface of the hole is circular, a lack of alinement in the two wheels results merely in an alteration in the position of the surface contact and not in its reduction, as is the case with straight teeth. The lubricant is consequently at all times well distributed over the surfaces, and the intensity of tooth pressure reduced.

ADVANTAGES OF THE HUMPHRIS GEAR

One of the principal mechanical advantages of this system is a strong and practically indestructible form of tooth, which is much thicker in the direction of pressure than an ordinary straight tooth of the same pitch, and therefore more capable of withstanding severe stress. In fact, owing to the large basal area and the short leverage, it is practically impossible to break the teeth off, and owing to the arched form of the material between consecutive holes, this portion of the gear possesses such strength that the shearing out of the piece would be practically impossible.

The effect of wear in the Humphris gear is to preserve the relative curvature of the teeth and holes, and not, as in ordinary gears, to flatten or even hollow the surfaces of contact.

Owing to the method of generation of the teeth, each hole is a perfect external envelop of the solid tooth that passes

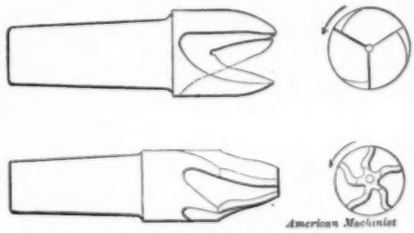


FIG. 5. TOOTH-AND-HOLE CUTTERS

into and out of it, consequently there is no backlash when the Humphris gears are correctly cut and depthed.

The evenness of running obtained by the Humphris gear reduces in a great measure the cost of repairs and renewals to other mechanical parts of the transmissions in which it is incorporated.

DURABILITY

Extended tests of the Humphris gears for different purposes are in progress, and the available results are sufficient to show that it compares favorably with gears of ordinary type. To quote specific cases, we may state that:

(a) A pair of case-hardened, mild-steel bevel wheels transmitted 29 horsepower continuously from July to December, 1910, at the Manchester School of Technology, where they were incorporated in the ventilating system and drove a 15-ft. diameter fan. No wear is measurable on either teeth or holes. These wheels were run in a gear case and lubricated with gear oil. They were a standard motor-car transmission set, and it is estimated that the amount of test running these wheels have done is equivalent to 30,000 miles in a motor car on the road.

(b) Sets of the Humphris spur gears have been fitted for trial in tram cars at Manchester, Middleton and Cardiff. Particulars from Manchester are not yet

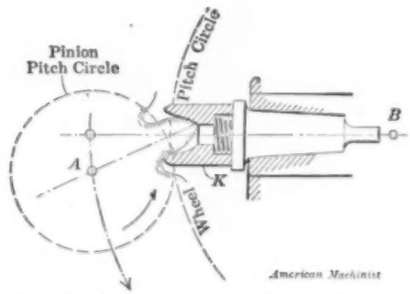


FIG. 6. GENERATION OF PINION TEETH

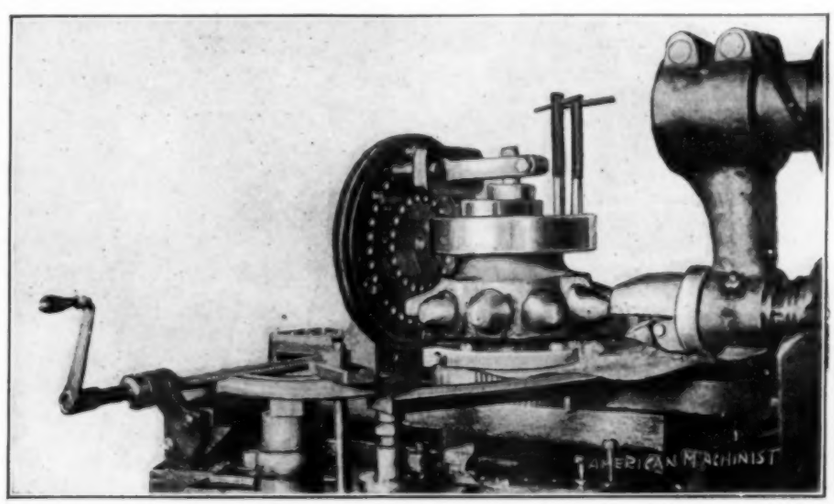


FIG. 7. GENERATING PINION TEETH IN THE MILLER

to hand, but with respect to the other two, the mileages to date and the average wear in the holes of the wheels are as follows:

Place	Mileage	Average Wear	Material of Wheel
Middleton	14,000	0.0235 inch	Cast steel
Cardiff	10,000	0.0346 inch	Cast iron

The pinions in both cases were of case-hardened mild steel, and the wheels were of cast iron in one case and cast steel in the other. The available wearing surfaces of these wheels were design-

edly cut down to less than half that of the ordinary spur gears they replaced, in order that a worn condition might be quickly arrived at, the object being to test the efficiency of the Humphris gear when badly worn. The wear, however, from the figures, is astonishingly small and the wheels will have apparently as long a useful life as a pair of spur wheels of twice the wearing surface.

In connection with this question of durability, there is a method illustrated in Fig. 10, of putting liners of steel (either hardened or soft), phosphor bronze, gun metal, fiber, or other suitable material into the holes of the larger Humphris wheels. The wheels can thus be made of cast iron and the liners can be renewed when necessary, thus doing away with the erection expenses of wheel replacements in inaccessible positions or at great distances.

It is also the practice to case harden the pinions deeply, thus greatly increasing their durability. Owing to the large size of the teeth, this can be safely done, and yet leave a core of soft material in the interior of each tooth sufficiently large safely to resist shock or stress.

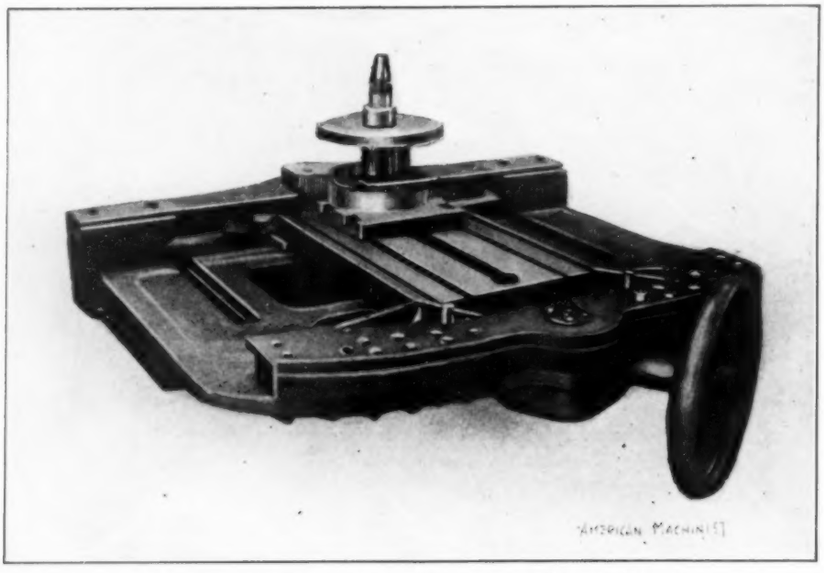


FIG. 8. CAM FIXTURE FOR GENERATING PINION TEETH

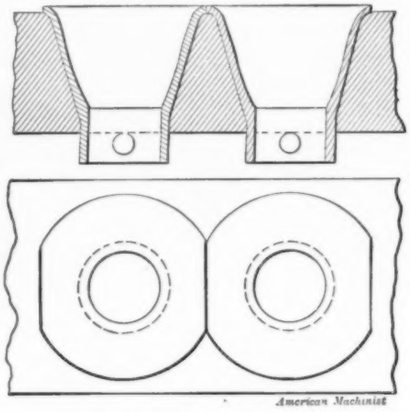


FIG. 10. LINED HOLES

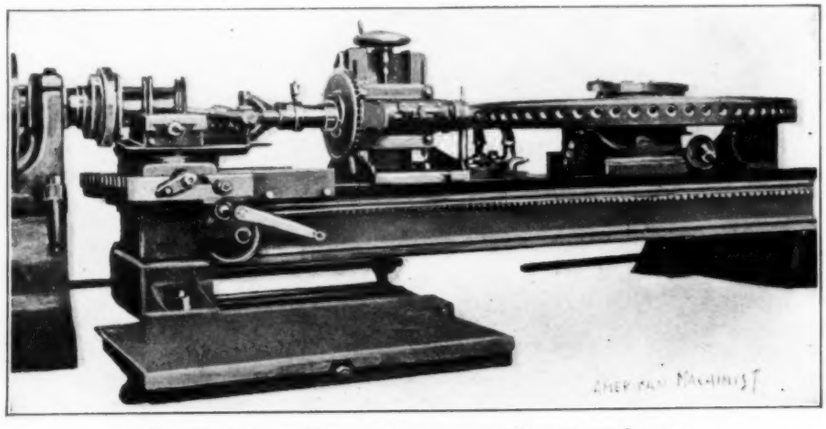


FIG. 9. BORING TOOTH HOLES IN A CONVERTED LATHE

METHODS OF MANUFACTURE

A large amount of experience has been accumulated as to the most suitable cutters and machine tools for carrying out the economical manufacture of wheels and pinions on this system. Dealing first with the production of the wheels, this is really a hole-drilling problem and presents no difficulty. Fig. 9 illustrates an old lathe bed converted into a wheel-boring machine by the addition of a vertically adjustable spindle adapted to take the special cutters, and driven through a universal jointed shaft from the lathe head. The wheel is mounted on an indexed rotary table, which is adjustable along the slide.

The first operation is to produce a male cutter from a sheet-metal templet of the outline of the hole, and this cutter, when finished and hardened, is used to form the inside of the female or hollow cutter. These cutters, when fluted, backed off and hardened, form the working set. The male cutter produces the holes in the wheel rims, while the hollow cutter is used in connection with a generator to produce the teeth upon the pinions.

Fig. 5 is an illustration of a pair of cutters so produced.

GENERATION OF TEETH

The process of tooth generation on the driving pinion consists of mounting the pinion blank on a generator base in such a way that it can be given exactly the same path across the fixed axis of the revolving hollow cutter as the finished pinion tooth will have relative to the axis of the hole in the wheel in which it eventually works.

For this purpose two circular motions are necessary. Referring to Fig. 6, in which the pitch circles of pinion and wheel are shown, the pinion rotates round its center *A*, and at the same time rolls around the pitch circumference of the wheel having center *B*. The axis of the hollow cutter *K*, being fixed as in a miller, the passage of the blank results in the formation of one pinion tooth of correct shape.

The pinion blank is constrained to move in this path with constant angular velocity by gearing or link motion, and a dividing plate is provided to which the pinion blank is secured, so that on the withdrawal of the blank after completion of a tooth the pinion is rotated through the angle corresponding to one pitch, and then resecured to the plate to cut the next tooth. The operation is commenced by a roughing or shell cutter which produces radial pins or cylinders upon the blank, these being finally pointed to the correct shape by the finishing cutter.

The writer, who has had considerable experience in the practical production of these gears, has also evolved a method by which, without a generator, the pinions can be produced on an ordinary miller provided with universal index centers, and this method saves expense where only one or two pinions of a size are required. The method can be applied to either spur or bevel pinions. In Figs. 7 and 8, a fixture is shown which gives the necessary circular motion to the pin-

ion by means of circular geared sectors, thus doing away with any links or other cumbersome devices for the formation of the teeth.

In the case of bevel gears the blanks are mounted so that the tooth axis makes the correct angle with the pinion axis, as shown in Fig. 11.

Since, by the method of cutting, the velocity ratio between the tooth and the cutting tool is constant, it follows that the velocity ratio between the finished tooth and the finished hole when in gear also must be constant. The hole is a perfect external envelop of the tooth during its passage, and this explains the closeness of fit obtainable at all phases of engagement.

For the manufacture of quantities of wheels of a given size, the production is extremely rapid and consequently cheap, owing to the coarse pitches, and the resulting small number of teeth. In addition, as in the majority of cases the larger wheel of the pair is the follower, on this system the rim of the wheel simply is drilled radially with the requisite number of accurately pitched holes.

Change Speed Bevel Gears

Within certain limits of velocity ratio, change-speed bevel gears can be cheaply produced on the Humphris system by drilling separate concentric rings of holes in the follower. The pinion is generated to a correct angle for the mostly used

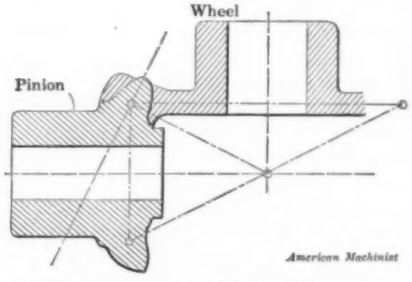


Fig. 11. Bevel Wheel Teeth

speed position, and operates in the others with hardly any loss of efficiency. The effect is due to the circularity of the hole sections in the plate, allowing for the alteration in the position, of the surface of contact, without reducing its amount. This accommodation is impossible in straight bevel teeth.

Efficiency of Transmission

Electrical tests of the efficiency of the Humphris gear have been conducted by the Electrical Standardizing Institution of London, and by the Manchester School of Technology. At the former institution, a set of bevels of case-hardened mild steel, with pitch suitable for a motor-car drive, showed an efficiency of 96½ per cent. at 10 horsepower. Fig. 12 shows the curve sheet of the Manchester School of Technology, giving efficiencies for different outputs and speeds, and rising to over 97 per cent. These tests were taken after the gears had been transmitting 29 horse-

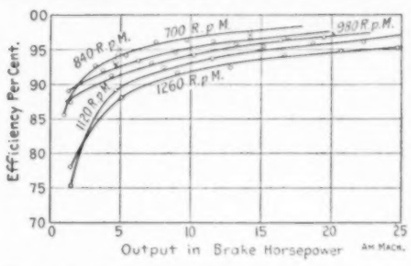


Fig. 12. Efficiency Curves from Test of Humphris Gears

power for about six months under a durability test.

Cast and Forged Gear Wheels

For quantity production of standard gears which do not require to be machine cut, the Humphris system is well adapted and the possibilities in this direction alone are very great. Accurate and smooth-working cast-iron Humphris wheels and pinions have been produced, the patterns usually being of metal. The pinions also lend themselves to drop-stamping processes, and in quantity production this would be the cheapest method of making steel pinions which required only trimming off and boring. Even for machine-cut pinions, drop-stamping of the blanks to approximate shape would economize both rough material and machine-shop time.

The possibility of manufacturing Humphris pinions from hot blanks by rolling them into gear with rotating wheel-dies is also evident.

The Toolmaker's Troubles

By A. L. Northwood

To one who has not had the actual experience, the demands made upon the versatility of the traveling toolmaker are almost past belief, and when one reflects upon the nature of the many tasks he is called upon to perform, it surely seems that very often he does not get his fair share of credit (or remuneration) for his usefulness to his employers.

It is true that the large firms do, to a great extent, specialize their tool-work, separating die making, jig and fixture work, and repairs; but the large majority do not adopt this plan and it is in such places that the all-round toolmaker has a chance to shine and make use of the experience obtained during his travels.

It is not a very great exaggeration to state, that in some places a toolmaker may be called upon to perform almost any operation around the works, from fixing the boss' eyeglasses to making sundry repairs on a ten-ton press.

It is quite true, that to be perfectly competent to fulfil the requirements made of him, he must have the requisite knowledge and ability to set up and operate every kind of machine tool; to calculate and cut the various kinds of gears; to lay out and machine cams; and he must be experienced also in the manufacture of jigs, fixtures, blanking and bending dies, and gages. Hardening also enters largely into his work, and the up-todate toolmaker must now know something of high-speed steel and its treatment.

It is often the extremely opposite nature of the work which comes his way, that causes much loss of temper and religion. It has been my own experience to be transferred directly from the refitting of all the slides on a No. 2 Cincinnati miller to the making of 0.3125-inch plug and ring gages. It is next to impossible for a man with his hands hardened and cut with heavy and rough work to have the necessary fine sense of touch for finishing work within 0.0001-inch limit, and it is right here that many foremen might well be more thoughtful and considerate.

Again, it is not fair to hire a man as a toolmaker, and set him, for his first job, to drilling 0.006-inch thick glass. It is not to his discredit if he is fired for falling down on such a job. Yet such an occurrence is within my recollection!

A little more consideration and knowledge of human nature on the part of many foremen, would do much to make the path of the toolmaker smoother, and the consequent serenity of mind and temper would undoubtedly be reflected in the improved quality and quantity of his work.

German Industrial Schools Recommended

The National Society for the Promotion of Industrial Education, 20 West Forty-fourth street, New York City, has just made a general distribution of the advance sheets of the report of the Wisconsin Commission upon Plans for the Extension of Industrial and Agricultural Training, recently submitted to the Governor of that State. The most interesting feature of the report is the recommendation with reference to the adaptation to Wisconsin conditions of the German system of compulsory day-continuation schools. Under the German Imperial law every State is allowed to establish day-continuation schools in which attendance is required of all apprentices under 18 years of age. By the same law, employers are compelled to allow the apprentices the time necessary for attendance. In these schools the apprentices are instructed in a wide range of subjects bearing directly on their progress and efficiency in their trades.

The report recommends the adoption of a law for Wisconsin making industrial training compulsory for all apprentices until the sixteenth year of age, and also of a law setting the length of working day for all children under 16, at eight hours.

The Work of Shop Inspection

By C. B. Auel *

The work and organization of a large inspection department, passing upon raw materials, semi-finished and finished products from outside, work in process, completed apparatus and the investigation of complaints.

A spirit of fairness and co-operation is necessary between the inspecting force and all whom they come in contact with.

*Assistant manager of works, Westinghouse Electric and Manufacturing Company, Pittsburg, Penn.

The necessity for a thorough system of inspection and the advantages to be gained thereby are now recognized by all modern manufacturing concerns, so that whereas 10 or 15 years ago the work of inspection was relegated to an inferior position among shop duties, it now occupies a place in the front rank, where it will positively remain for all time.

In support of these facts, to anyone disposed to question them, an illustration or two may readily be cited.

The business of consulting engineering is assuming larger proportions every year due to the tremendous strides being made in the manufacturing industries. If one stops to analyze the functions of a consulting engineer, it will be found that inspection duties form a very considerable part of them. For example, in the designing of a power and lighting plant, even after the requirements of the case have been worked out in regard to the capacities of boilers, engines, dynamos, rotaries, transformers, etc., the consulting engineer must further know what to recommend specifically to his clients or what to choose from; this he could not do, unless he had previously acquainted himself with the various makes of apparatus involved, their relative merits and demerits, the methods of the concerns offering them, the standard of their engineering talent, the quality of their work and the like.

In fact, a knowledge on any or all of these points is frequently necessary to the consulting engineer from the very commencement of a design, either as enabling him to make broad-gage plans, or, on the other hand, as confining him within certain narrow limits. Further, when the order has been placed it is still the business of the consulting engineer to follow the apparatus while under construction, test, erection and, for a time, in its subsequent operation. During all of this period the consulting engineer is, whether consciously or unconsciously, balancing the products of one firm against those of another; in consequence forming new opinions or strengthening old ones. These, in turn, extend themselves in due course and in greater or lesser degree to his clients and their opinions are finally reflected back upon the firm, either directly in the form of additional orders or indirectly in the light of advertising, good or bad as the case may seem to warrant.

As another illustration of the growing importance of inspection, there are being established testing or inspection bureaus that make a business of inspecting and testing factory and mill products at regular intervals, along such lines as porcelains, rubber-covered wires and cables, flexible tubing, conduit, hose, fire hardware, bar steels, etc., providing label service or the equivalent for all materials inspected and passed by them. The general purpose of such inspection is, as one firm of this kind states, "not only to provide consumers with the fullest possible guarantee of reliability and the maintenance of high standards in design and materials, but, at the same time to afford to manufacturers means whereby their products will be easily and universally recognized in the field, in distinction to inferior and unapproved goods; and, further, that such inspection will be an aid to manufacturers in keeping up the quality of work and supervision to a point which will best serve the interests of all concerned."

It is seen, therefore, how largely the work of inspection is entering into the manufacturing industries. One may be well assured that in these days of keen competition and close scrutiny of expense of all kinds, an inspection force must be considered a good investment by every firm establishing or employing one or it would not be tolerated.

Organization of a Large Inspecting Department

Taking the Westinghouse Electric and Manufacturing Company as typical in its methods of the large engineering concerns, its inspection department which is under the supervision of the manager of works, consists of several hundred men nominally divided into two sections: one for the inspection of apparatus building in its own works, the other for the inspection of all materials coming in from outside manufacturers, including the various raw and partly finished materials, also for apparatus of its own manufacture returned for any reason, such as for repair or exchange, from loans or exhibits, etc. All inactive and obsolete stocks, both raw and finished, are likewise regularly inspected with a view to disposing of them to the best advantage.

Materials coming in from outside manufacturers are generally inspected upon arrival at the works, though certain items, such as bar steels, pulleys and those of special nature like turbo-generator castings or forgings, are often given a preliminary inspection or test at the place of manufacture.

In addition, representatives of the company are sometimes delegated to inspect the works of manufacturers with whom there seems a likelihood of doing business, to see if their facilities are such as to enable them to furnish materials of the degree of excellence required.

Specifications for the guidance of those concerns desiring to supply materials to the company, have been prepared by a committee, known as the "Material Committee," which set forth the company's requirements, tests, guarantees and so on. These specifications are also made use of by the inspection department in seeing that the materials supplied are actually as ordered.

As may be imagined from the ramifications of the electrical industry, a very wide range of subjects must be covered; nevertheless, the specifications have been compiled with the greatest care and are revised and added to whenever experience dictates, so that they are practically always uptodate. In the preparation of data of this kind the desirability of using commercially standardized materials whenever possible is thoroughly recognized, not only because of the lower cost but also on account of the ability to obtain supplies more readily and, perhaps most important of all, for the reason that standard materials are much more apt to be homogeneous and more uniform in quality than special materials. At the same time the fact is fully appreciated that there are requirements which the conditions of the electrical industry call for and which must be fully met. The result is that the material specifications represent in many instances a compromise between the best theoretical and the best practical ideas.

A typical material specification covering leather belting as purchased by the company is given herewith.

Leather Belting Specification

General: This specification is intended to cover miscellaneous sizes of leather belting for general use.

Material: Belting must be of the best quality of oak-tanned leather, free from all ingredients in any way injurious to

the life or wearing qualities of a belt, or that simply add to its weight.

Location of cuts: Belting must be cut longitudinally; no piece of hide must exceed 54 inches in length; widths less than seven inches to be cut within 15 inches of the center of the hide; widths seven inches and over to be cut from the center; neither shoulder, belly, side, nor flank stock, nor any padding or shimming will be permitted; it must be of uniform thickness and width, and be perfectly straight from end to end.

Under a strong magnifying glass the way in which the leather has been cut, whether longitudinally or crosswise, may generally be determined by the follicles or hair cells, and if their direction is other than longitudinal, this may be considered cause for the rejection of the length of belting under inspection.

Laps: Laps must not be less than four inches, nor more than eight inches, excepting that in single belting eight inches and over in width, the lap may be one inch longer than the width of the belting; no lap should be within four inches of the end of a strip. Laps must be thoroughly cemented and when pulled apart, the exposed surfaces must not show any resinous, vitreous, oily or watery condition; no rivets will be permitted.

Weight: Belting not waterproofed must come within the following range of weights, which must be guaranteed to be not more than 10 per cent. in excess of the actual weight of the leather.

SINGLE BELTING

Width in Inches	Minimum weight, ounces per square foot
1 to 2	13
2¼ to 4	14
4½ to 5½	15
6 and over	16

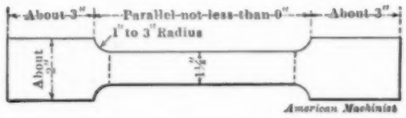
DOUBLE BELTING

Width in Inches	Minimum weight, ounces per square foot
1 to 2	24
2¼ to 4	26
4½ and over	28

Physical properties: Belting must have an ultimate tensile strength, both in the leather and in the splice, of not less than 3600 pounds per square inch, and must not show an elongation in two inches to exceed 13½ per cent., when measured under a load of 2250 pounds per square inch for one hour.

Belting must not crack open on the grain side when doubled strongly by hand with the grain side on the outside, nor must it show piping or raising on the grain side when similarly treated with the grain side on the inside.

Test pieces having the following dimensions for tensile strength and elongation will be cut from belting with a die: See drawing.



When belting is required for any special purpose, the manufacturer will be notified as to the nature of the work, the maximum horsepower, speed, etc.

Making: Belting must contain the manufacturer's name, trade mark or the equivalent, on every 10 feet.

Rejection: The Westinghouse Electric and Manufacturing Company reserves the right to reject any portion or all of the material which does not conform to the above specifications in every particular and to return the rejected material to the manufacturer or seller for full credit at price charged f.o.b. point of delivery specified by the purchaser. If the material is to be replaced, a new order will be entered at prices, terms and conditions acceptable to the purchaser.

Pur. Agt's No..... INSPECTION REQUEST FOR MATERIAL No.....
Requisition No..... RECEIVED. FOR STOREROOM....
.....19

From Whom .....

DESCRIPTION

Number of Cases	Number of Articles	The Stockman is hereby authorized {to put above material into stock. to hold " " until further notice. For statement of defects see other side.

..... Chief Inspector.
Per.....
Received by .....
Charge to .....

FIG. 1. FORM FOR INSPECTION REQUEST

USE OF LIMITING INSTEAD OF EXACT DIMENSIONS

As is pointed out further along in this article in connection with the inspection of work in the shop and the beneficial results to be derived from working to limiting instead of to exact dimensions, it would be equally desirable if some method could be devised whereby inspectors of materials could be assisted in their work by furnishing them with standards such as samples, curves or other data showing the limits between which materials could be passed, thus reducing to a minimum the possibility of errors in judgment. The idea intended to be conveyed is exemplified in part by maximum and minimum gages, where such can be used, the material when inspected for correctness in size being supposed to be not greater than the larger nor less than the smaller of the two gages. In the case of colors, two samples would similarly be chosen as standards and all material would be required to be not lighter than one nor darker than the other. However, many materials do not lend themselves to gaging of this sort, as for instance, the matching of marble with respect to the grain or veins, a matter quite apart from matching it for color. This indefiniteness is apt at times to cause confusion on the part of manufacturers as to what is necessary, or possibly disappointment on the part of customers as to what they received.

A very complete chemical and testing laboratory is further maintained by the company and full advantage is taken of it not only in the preliminary testing of raw materials, but also in the examination of partly finished materials or apparatus at various stages during the process of manufacture.

Careful records are kept of materials rejected or found defective in any respect and steps are taken to see that such materials are promptly disposed of in order to prevent any possibility of their becoming mixed with accepted materials. At the same time the suppliers are communicated with in the most expeditious way, so that the defects may be made good with the least possible delays. Fig. 1 shows the form used by inspectors when rejecting any materials supplied by outside manufacturers which form is, as stated, amplified by letters, etc., to the suppliers of such materials.

NOT NECESSARY TO INSPECT EVERY PIECE

In the inspection of the company's apparatus, endeavor is constantly made in each department to inspect the work during the actual making as well as upon the completion of it. The company is a firm believer in the "ounce-of-prevention-is-better-than-a-pound-of-cure" method, though an occasional lesson is very effectively learned the other way. When the statement is made that in the storeroom ledgers there are listed approximately 85,000 different items, one will appreciate in some degree, the enormous volume of work going through the works and consequently through the inspection department.

Of course, it would be a physical impossibility, without increasing the force to a disproportionate size, to inspect every individual piece. It would also be equally unnecessary to do so since many of the items are made either by automatic or semi-automatic machinery or the equivalent, and all such it is sufficient to inspect on a percentage basis, as for example, screw-machine parts and other

repetition work. After the tools are once properly set for work of this kind, it is only necessary to prevent them wearing or getting out of alinement. When this contingency has been guarded against, an inspection of a few per cent. of the finished material is quite efficient as an inspection of every piece. On the other hand, apparatus which is not made by automatic devices or which is not manufactured in sufficient quantities to warrant the making of dies, limit gages,

INSPECTION TAG

G. O. No..... S. O. No.....
Style No..... Drawing No.....
Inspected.....191
BY.....

FIG. 2

MACHINE IDENTIFICATION TAG

Type.....Volts.....H.P.....
Frame No.....Arm. No.....
S. O. No.....
L. No.....S. No.....
Defects.....
Assem. to Ship by.....
Date.....191
Running Test O. K. by.....
Date.....191
Insulation Test O. K. by.....
Date.....171

FIG. 3

templets, etc., requires detailed inspection of all its parts, and this the company aims to give.

Next to inspecting the work before it leaves the machine or bench, that is, while still uncompleted and in the hands of the workman, the second best method is to have the material after each operation delivered with its indentification tag over a counter or into a separate inspection room where it can be thoroughly inspected and passed or rejected. If satisfactory, it is retained and in due course reissued over the counter to another workman for the succeeding operation. Where the work is small this method will give excellent results. But in the majority of instances a procedure of this kind is not permissible on account of the large size or awkward shape of the pieces which would require too much labor to handle. It then becomes necsessary either for the inspector to go to the work and inspect it, stamping it with his special stamp if satisfactory, or else to have the work stacked on the floor around his desk or table where he can readily get at it. It will be found advisable when the size of the piece permits to stamp it while in the rough state with a serial number and to link each serial number with the check numbers of the various workmen who perform work on it. In this way defective work can always be traced back to the right person, no matter what the lapse of time may be between the performance of the work and its inspection.

In some few classes of apparatus the nature of the work is such that each operation serves as a check on the preceding operation. Where such is the case the workmen themselves act as inspectors. Carrying this idea out still further, some concerns hold each workman responsible for any work that may be performed by him on a piece on which any

INSPECTION AND MACHINE IDENTIFICATION TAG

Type.....
Output.....Volts
Amps.....Speed.....
Cycles.....Foles.....
Rotating Part | Stationary Part
Serial No.....
Order No.....
Remarks.....
Approved.....191...
By.....
Inspector

FIG. 4. MACHINE INSPECTION TAG

ARMATURE CORE

Is shaft stamped by inspector?.....
Is spider stamped by inspector?.....
Pressure of spider on shaft.....
Fit of punchings on spider and key.....
Pressure used in building core.....
Length of core and spacing of vents and spec. punchings.....
Location of core relative to shaft shoulder.....
Balance of core.....
Filing of slots.....
Serial.....
Order.....
Inspected by.....

FIG. 5

of the preceding operations by other workmen have been incorrectly done.

Inspection Tags and Reports

Tags of various kinds are used in the inspection of the company's apparatus, several of these being shown in Figs. 2, 3, 4, 5, 6 and 7. It will be noted that Figs. 5, 6 and 7 contain a list of questions which the inspector is required to answer before passing the apparatus, and most of these have been so worded as simply to call for a "Yes" or "No" instead of for a more lengthy reply. Any aid of this kind invariably proves of the greatest assistance to the inspectors and more especially where new ones are being trained to the work and may not know quite all of the points to look for.

All defects or deviations from the drawings or specifications, noted by the inspectors during the inspection of material or the building of apparatus, are given most careful consideration to determine whether the piece should be scrapped outright, whether it may still be rectified, or, if the feature be an unimportant one, whether the material or apparatus may be passed as it stands. Of course, a full knowledge of the situation is required before an intelligent decision can be arrived at. If a decision cannot be given by the inspector himself the matter is at once referred to the heads of departments involved. In the meantime, if it seems advisable, all work which is likely to be affected in any way is stopped pending a definite conclusion.

Defects are further recorded by the inspectors on regular printed forms, Figs. 8 and 9, which are transmitted daily to

ARMATURE COMPLETE

Is commutator stamped by inspector?.....
Tinning commutator necks.....
Pressure of commutator on spider.....
Location of commutator on shaft.....
Relation of commutator bar to armature slot.....
Tinning of armature conductors and clips.....
Fit of coils in slots.....
Shape of coil regarding supports and throw.....
Throw at commutator and at rear end.....
Soldering.....
Filing clips and cleaning commutator necks.....
Banding.....
Turning commutator.....
Oil wipers, good wearing face and distance between journals.....
Serial.....
Order.....
Inspected by.....

FIG. 6

COMPLETE MACHINE

Has frame been cleaned and painted inside?.....
Are field coils tight and is bore of field correct?.....
Are poles evenly spaced?.....
Do interpole bolts extend beyond pole face?.....
Are connections between field coils properly cleaned and insulated?.....
Has flame proof braid been removed from brush holder leads and replaced by tape?.....
Are housings entirely free from dirt and core sand?.....
Do bearings and housings fit and is alignment correct?.....
Are oil grooves chipped in cells?.....
Is drain hole provided for waste oil?.....
Are brushholders properly spaced and brush tension correct?.....
Are brushes parallel with commutator segments?.....
Are oil covers properly fitted?.....
Is pinion tight on shaft and key properly fitted?.....
Does gear case clear gear?.....
Did commutator develop high-bar on test?.....
Serial.....
Order.....
Inspected by.....

FIG. 7

INSPECTION FORMS IN THE SHAPE OF TAGS.

the office of the chief inspector. Here they are carefully gone over and analyzed and such steps taken to prevent a recurrence of them as may, from the nature of the reports, be deemed necessary.

These daily reports are classified weekly or monthly, Figs. 10 and 11, according to the apparatus, the kinds of defects, whether of design, workmanship or material, and the sections of the works in which they occur. Copies of these classifications are forwarded to all departments concerned, including the manager of works department, the engineering departments, the assistant superintendents, and the principal inspectors.

Name of Parts	O. K.	Returned for Further Work			Scrapped		
		68	69	70	68	69	70

Inspection Report for Sec.....
for Week Ending.....
Signed.....

Fig. 8. ANOTHER INSPECTION FORM

REPORT OF APPARATUS FOUND DEFECTIVE ON TEST

Description of Apparatus:
.....
.....
.....

Serial No. of Apparatus { *Rot* ..... } *Sequence of Machine on S. O.*.....
{ *Sta* ..... }

Built in Section.....

S. O. No.....
Date of Report.....

Copies to .....
.....
.....
.....

Name of Customer

Report of Defect and Probable Cause

Signed

CHARGE HAS BEEN MADE TO.....*Date*.....191

FIG. 9. REPORT FORM FOR DEFECTIVE APPARATUS ON TEST.

Curves are also plotted from this data on a monthly basis, showing various relations, as for example, total production and defects due to workmanship and material, Fig. 12, total labor and material losses in each department due to defective workmanship and defective material, their relation to total productive labor in that department, etc., Fig. 13; when necessary further sub-divisions are also made.

Complaints received from outside, that is, either from the erecting department or from the district offices (through the medium of the correspondence departments) are, if applying to the works, referred to the inspection department where they are thoroughly investigated, after which a written report is made on each to the manager of works, and to the erecting department or to the correspondence department for transmission to the proper district office. These complaints are likewise classified on a monthly basis and treated similarly to defects occurring in the works. When the complaints received from outside affect the design only they are referred at once to the engineering departments where an analogous course of procedure is followed.

A record of all complaints is maintained by the management to whom are transmitted by the correspondence, erecting, engineering, manager of works department and the district offices copies of such correspondence as may be required from time to time in connection with any further inquiry which it may seem desirable from the point of view of the management to institute.

INSPECTING FOR DEFECTS IN WORKMANSHIP

Defects due to workmanship are undoubtedly more difficult to deal with than those due either to design or to material, though it is not the intention for a moment to convey the idea that any of them is easy. Reference is had here more particularly to items of a minor nature such as form the bulk of defects. When a design has been supposedly corrected, it is, of course, possible that instead of eliminating trouble one may be simply getting into trouble of a different kind. Assuming the solution to be at hand it becomes a question of changing records and drawings when the matter is then closed once for all. In the case of a defect due to workmanship, however, while letters or any other information may be sent to the manufacturing departments giving full instructions how to proceed in future, it is necessary to follow up such instructions continuously in order to see that they are properly carried out, not only for a time but all the time.

It will readily be seen how this may be so when one considers that in a very large works, such as the Westinghouse Electric and Manufacturing Company with thousands of employees, there are always a certain number constantly coming and going. The new ones require to be taught ways and methods. It being impossible

SUMMARY OF WEEKLY INSPECTION REPORTS

Division Material

| Date / Week Ending | Name of Parts | | | | | | |

for various reasons always to give the older hands the same work each time; they too must be coached. As this work falls principally upon the foremen who should invariably be well backed by the inspectors, it is evident that with a great variety of manufacturers, neither the one nor the other of these positions may be said to be a sinecure.

Attitude of Inspectors and Foremen

In choosing inspectors endeavor is made to obtain men who have had the requisite experience in the works; and, if possible, in the departments where the inspection is needed. In addition, such men should be selected as are imbued with the responsibilities of their positions and with an abundance of good judgment not only for passing upon materials or apparatus submitted for inspection but also for dealing with the men about them. As regards their dealings with the men about them inspectors should be absolutely fair and impartial. No measure of discrimination should be meted out to one workman that is not given to another. A feeling of cooperation must also exist between the inspectors and the foremen, if the work of inspection is to be carried out effectively. The old notion, held by some, that no harm is done but rather good accomplished when the inspectors and the foremen are inclined to be at logger-heads, or to view one another with suspicion as to their relative fitness for the position which each holds, is the worst of fallacies.

INSPECTION DEPARTMENT

REPORT OF DEFECTIVE APPARATUS

For the Month of.....

		Insulation	Winding	Bearings	Air Gap	Wrong Parts	Ratio	High Losses	Wrong Connections	Commutator and Collector	Balancing	Dynamo Test	Detail Test	Miscellaneous	Total Shop Defects	Total Engineering Def'ts	Total Shipped	% Defective Shop	% Defective Engineering
B. C. & D.	51 A.C. Turbo Generator																		
	52 D.C. " "																		
	53 A.C. Rev. Fld. Type																		
	54 Rotary Converters																		
	55 Induction Regulators																		
	56 Other D.C. Machines																		
	57 Induction Motors																		
S. & T.	58 A.C. Rev. Fld. Type																		
	59 Rotary Converters																		
	60 D.C. Machines																		
	61 Induction Motors																		
	62 Induction Regulators																		
W.	63 D.C. Machines																		
	64 Polyphase Motors																		
	65 Single Phase Motors																		
M.	101 Small Power Motors																		
A. & F.	66 D.C. Ry. and Hill Motors																		
	67 Mining Motors																		
	68 A.C. Ry. Motors																		
	69 Compressor Motors																		
	70 Multiple Unit Control																		
	71 Drum Controllers																		
	104 Miscellaneous Parts																		
E. & P.	72 Transf. (over 50 K.W.)																		
	73 " (up to 50 K.W.)																		
	74 " Series and Shunt																		
	75 Arc Lamp Rectifiers																		
K.	76 Scenoid Control																		
	77 Face Plate Control																		
	78 Oil Switches																		
	79 Circuit Breakers																		
	80 Switchboard																		
	81 Heating Apparatus																		
	82 Rectifier Bulbs																		
	83 Misc. Detail Apparatus																		
	84 Line Material																		
	91 Auto Starters																		
R.	85 Locomotives																		
	86 Locomotive Motors																		

FIG. 11. INSPECTION MONTHLY REPORT FORM ON DEFECTIVE APPARATUS

Inspection of Apparatus

Concerning the apparatus itself, this must be inspected with regard to its fitness for the use intended and here is where discrimination may be shown to good advantage. Drawings call usually for absolute measurements; that is, they give single dimensions only to be worked to and do not, as a general rule, specify what will be accepted and what will not in the matter of variation from the absolute size. It is sincerely to be hoped that whatever objections exist at present which prevent the specifying of limits or of two dimensions on drawings may ultimately be overcome, at least to the extent of introducing them on drawings for standard apparatus. As it is neither possible nor necessary in the vast majority of commercial operations to reach an absolute degree of refinement the question is then one of relative accuracy. In other words, between what limits of variation either way from the exact dimensions must the error, should one choose to call it such, be confined if the work is to be thoroughly satisfactory. No proper answer can be given until the nature of the work be known.

If the piece be a casting and no finish shown on the drawing certain parts of it may perhaps vary as much as one quarter inch or more, either plus or minus, from the dimensions specified and no harm be done. On the other hand, if it be a press fit that is in question, the variation from the exact dimensions may be limited possibly to 0.001 inch and that in one direction only. In illustration, when determining the bore in a large cast-steel turbogenerator field disk it was found necessary to allow 0.003 inch for expansion due to heating and 0.005 inch additional for centrifugal force, a total of 0.008 inch. Under these circumstances, if the diameter of the shaft were to be made only equal to the diameter of the

bore of the disk it would positively rattle on the shaft when the machine was in operation. If instead, the diameter of the shaft were made 0.008 inch larger than the bore of the disk, that is just enough larger to equal the total expansion, the chances would still be good that it would float or creep up and down the shaft. To take care of expansion and still have a tight fit under operating conditions it was calculated that the shaft should be made 0.010 inch larger in diameter than the bore of the disk. Anything less than this would probably have been insufficient, while anything in excess might possibly have resulted in rupturing the disk when pressing the shaft into position. In a case of this kind, therefore, it will be seen that the utmost exactness is required and practically no variation from the drawings is permissible.

Here are two samples of opposite extremes; one allows a maximum variation from the given dimensions, in the other no variation whatever must enter. Between these, there is an almost infinite number and variety of graduations. It is the business of the inspectors to differentiate between them—by no means a simple task—and upon their respective abilities to do so depends their success in the inspection department; the fact of their success in this department should serve as a guarantee of their eligibility for still further advancement. The company in selecting foremen gives preference to inspectors and rate setters, or "feed and speed men" as the latter are sometimes called. As may be surmised men with the proper qualifications for inspectors are exceedingly difficult to obtain from the ranks of skilled artisans, for, while practically every inspector must be a journeyman to some trade it is not every journeyman who is competent to be an inspector.

Co-operation in Inspection

There is no better field for coöperation, nor one in which either the results of it or the results from lack of it, may be more clearly seen than in the work of inspection. The efficiency of inspection depends in very large degree upon the aid received from the engineering, correspondence, testing and other departments, members of which are always more or less in touch with manufacturing processes and are thus enabled to make many helpful suggestions regarding the work. Of equal value are the letters received from the erecting department and the various district offices even though these be, in some instances, complaints, regarding defects in apparatus. Inspectors are constantly being impressed with the fact that no one can estimate the possible harmful effect any trouble, even when trivial, may create in the minds of customers. Therefore, every letter of complaint is accepted at its full face value and thoroughly investigated; first, with a view to ascertaining the cause of the trouble, second, with a view to taking such steps as will if possible prevent a recurrence of It will be found decidedly efficac when complaints are received involv defective workmanship to send now ar gain the foreman or the inspector of th department in which the apparatus was uilt to see for himself the cause of the rouble. In this way their viewpoint will be broadened and they will appreciate even more fully than they otherwise would the necessity of the apparatus from the works.

No matter how adequate the precautions may be to have nothing but perfect apparatus shipped from the works there will be certain points, particularly in connection with new lines of apparatus or in new applications of standard apparatus, that can only be gleaned from actual experience. Hence, the works are dependent to quite an extent upon the district offices and the erecting department in keeping them thoroughly posted on all matters of this kind.

Since so much assistance in the work of inspection is received from channels other than the inspection force proper it may be said that, while the inspection department, consists nominally of a force of several hundred men, in reality this number is only a nucleus and would be totally inadequate for the work did it not have the heartiest support, not alone from the various manufacturing departments but from the engineering, erecting, correspondence and testing departments and the district offices as well.

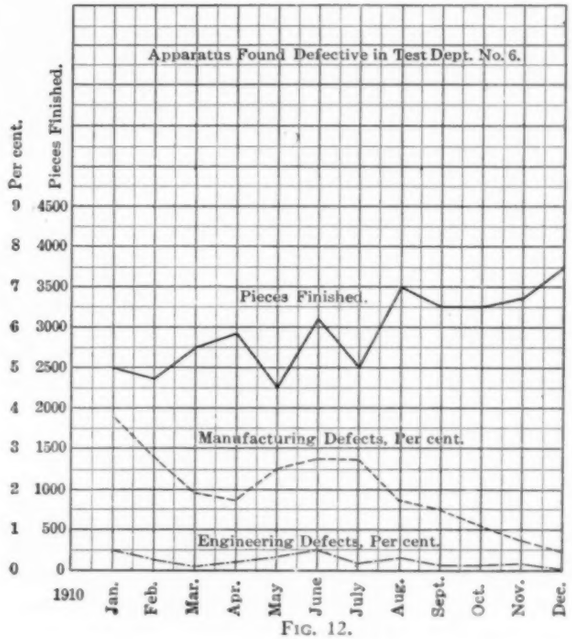


Fig. 12.

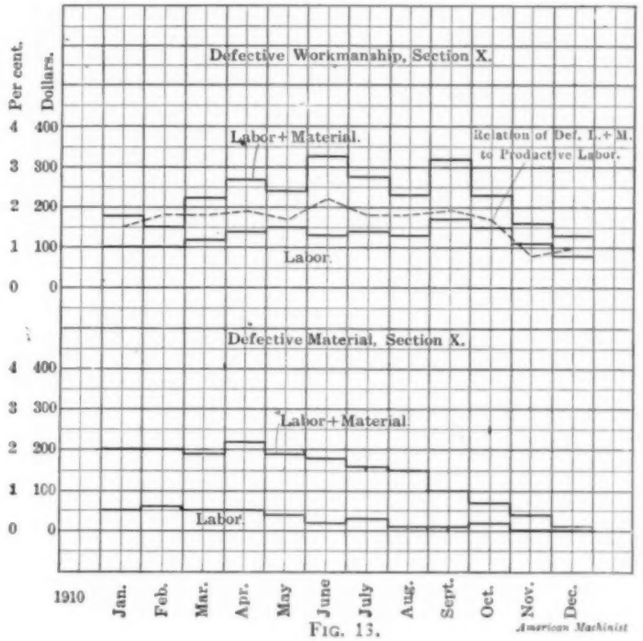


Fig. 13.

Curves Showing Percentages of Defective Material

Some of the things to be considered in selecting wheels are: the sizes of grains and the tensile strength of the bonding material necessary for the particular metal that is to be ground; the tensile strength or hardness necessary to withstand the vibrations brought about from mechanical defects in design of the machine on which the wheel is to be mounted; contact—whether broad, narrow, long or short—between the wheel and work; speed of wheel and work, and sometimes other conditions.—*Grits and Grinds.*

Convention of Manufacturers

The sixteenth annual convention of the National Association of Manufacturers was held in New York City on May 15, 16 and 17. In addition to the usual reports of committees and general business, the important work of the meeting was in connection with accident prevention and relief; in fact the major part of both morning and afternoon sessions on Tuesday, May 16, was devoted to this subject.

Mr. Schwedtman presented the report of the committee on industrial indemnity insurance. This report in book form was reviewed in our last week's issue, page 943, and declares for a policy of accident compensation, as opposed to a policy of employers' liability.

James A. Emery, associated with Mr. Schwedtman on this committee, addressed the convention on "How Workmen's Compensation Plan Can Be Effected by Taxation." He compared the principles of the English and German systems of accident relief, outlined the constitutional difficulties in this country in putting such principles into force here, and then declared in favor of using the taxing power of the State as a means of raising funds for industrial compensation; thereby distributing at least a portion of the burden of industrial accidents upon the whole community. A set of resolutions indorsing this plan was adopted by the convention.

He was followed by M. A. Alexander, who stated that our first laws in regard to accident compensation must be educative in character. It is more essential to train up a body of workers who will make intelligent use of safety devices and exercise an intelligent care of themselves and the machinery and property that they handle, than it is to devise machinery which is "fool proof."

A valuable part of the program was an exhibition of safety devices shown in a room adjoining the convention hall. This feature is briefly mentioned in another column on this page.

To show the constructive work that the association intends to do during the forthcoming year, the following resolutions were adopted:

RESOLVED, That the following cardinal principles and explanations are the basis for our Association's future legislative activities in the direction of Accident Prevention and Workmen's Compensation.

First: All legislation must be for compensation (every kind of employers' liability legislation has proved a failure in every civilized nation).

Second: Compensation legislation must cover every wage worker. (The man who, without his own fault, loses his hand in the farm machine is as much entitled to compensation as the engineer who loses his hand in an engine gear.)

Third: Compensation must be assured. (It must be as certain as the interest on United States bonds. This can be accomplished through insurance, approved and preferably guaranteed by the State or National Government. However, every safe method of such approved insurance should be permitted. State, mutual and stock insurance, as well as relief systems, covering individual shops, should be encouraged and none of them must be barred.)

Fourth: Compensation must be efficient. (Not less than 75 cents and preferably 90 cents, out of every dollar paid into the insurance fund should be paid to injured workers or their dependents. To this end, legislation and solicitation expenses must be reduced to a minimum, and Arbitration courts, or a simplified court procedure, are required for settlement of disputes.)

Fifth: Employer and employee are jointly responsible for all unpreventable accidents and should therefore jointly meet the compensation expenditures (the employer covering approximately that part which is due to his fault and the inherent hazard of the industry; the employee covering approximately that part which arises from his fault).

Sixth: Every injury, except those due to criminal carelessness or drunkenness on the part of the worker, should be compensated.

Seventh: Humanity and efficiency demand that prevention of accidents is made of prime importance.

The important addresses of Wednesday dealt with the consular service and extension of foreign trade. A glowing picture was presented of the trade opportunities in South America, particularly Argentina, and American manufacturers were urged to enter the field. Stress was laid upon the sending out of intelligent representatives, men having ability to adapt themselves to the people and country, and who can speak the language. The often repeated cautions were given to send down advertising matter printed in Spanish—not English—and to follow instructions in quoting prices, packing for export and shipping.

The usual enthusiastic banquet closed the convention.

National Exhibit of Accident Prevention Devices

In connection with the convention of the National Association of Manufacturers, held at the Hote Waldorf-Astoria, in New York City, May 15, 16 and 17, there was given an exhibition of photographs of various safety devices employed by many different manufacturers for the prevention of accidents in their plants. These photographs were supplemented by numerous diagrams and charts, taken mostly from German statistics, bearing upon the subject of industrial accidents and different schemes of accident insurance.

The object of this exhibition was not only to impress upon the public and manufacturers in particular the tremendous losses due to preventable accidents, both from the humanitarian and monetary view points; but to act as a clearing house of information regarding accident-prevention devices. Each visitor was requested to carefully examine the various exhibits and then to note upon a prepared blank form those devices which proved most interesting to him or applicable to his business. The object of this was to establish correspondence between the interested parties for the interchange of ideas along these lines, that all might have complete information and all possible aids toward the installation of safety devices.

Many manufacturers are genuinely interested in this subject, and some of the appliances were of unusual interest. Among these was a crane hook with a handle at the back, to avoid the necessity of grasping the hook where the hand might be crushed. Others were most substantial and sightly gear guards made of angle irons and heavy wire mesh; also punch presses requiring both hands to trip, preventing the placing of either hand in danger. Still again, as a minor feature, there were openings in doors and at partition corners, so that two persons approaching from opposite directions could avoid collision. Several companies issue to their employees, booklets of instructions, especially relating to safety measures, one such being printed in ten languages. In this case it was clearly stated that the company holds each foreman and department head strictly accountable for accidents to employees, and the penalty for anyone taking any needless risk is dismissal.

One sign exhibited read: "Unless you are willing to be careful to avoid injury to yourself and fellow workmen, do not ask for employment. We do not want careless men in our employ." This sign came from a well known maker of steel tubing.

Still another company has this sign in its drafting office: "Take the necessary time to see that every drawing which YOU make FULLY provides for the safety of employees."

Aside from humanitarian reasons, the association is laying strong emphasis upon the saving in dollars and cents by the employment of safety devices. It is pointed out that very large reductions can be secured in liability-insurance rates, to say nothing of damage suits, demoralization of operatives after accidents, and other causes of reduced efficiency, aside from the general public economic loss for the support of maimed persons and their dependents.

The Training of Industrial Foremen*

By Charles Park†

We are beginning to feel that with all our efficient machinery and modern methods of manufacture the absence of systematic training is placing our industries in a serious situation, and it has been stated that "today we are reaping the sorry harvest of neglect." This condition is not only most unfortunate for the industries, but it is also deplorably unfortunate for the workmen.

What reason is there to expect that untrained workmen will ever exercise any initiative or that they can ever become leaders, even in a small way? How can they ever progress even from the smaller things to the larger ones, or how can they ever become qualified for positions of responsibility, such as foremen, superintendents or shop managers? To be sure many men have developed under these conditions, but not because their work gave them proper training, but because they were naturally superior men. My appeal in this paper is for training that will develop the superior man. But I appreciate that there is also urgent need of industrial training for the great mass of ordinary workmen.

The superior man cannot get the desired training in the shop, and the lack of men able to carry small responsibilities or to fill the positions of greater responsibility comes from the lack of training of the workmen themselves, from whom we must select the leaders. Sound industrial education has seemed to several philanthropists to be the remedy.

A number of years ago Dr. Abbott Lawrence Lowell, the trustee of the Lowell Institute, foresaw the value of such training, and in 1903 he made a change in the work done by the Lowell Institute in connection with the Institute of Technology. The purpose underlying this change is as follows:

We have heard a great deal of late years of captains of industry; but the efficiency of the industrial art depends, in a very large measure, and probably to a constantly increasing extent, upon the capacity of its non-commisioned officers—in other words, upon the foremen. These men receive the same education today as the ordinary mechanic, and it has been thought that it would be a great benefit to the community at large if they could have some instruction in the principles of applied science, so that they might understand more thoroughly the work they are superintending, and be ready to apply improvements. It is felt, also, that a better educated class of foremen would be a benefit to the community socially, as an intermediary class between the employer or engineer on the one hand, and the workmen on the other. To attempt, however, to train young men separately for the position of foremen would be under the existing organization of labor an impossibility. The foremen must continue, for the present at least, to be promoted from among the workmen. In giving them such an education as is desired, therefore, it is necessary to take men who are already working at their trade; and hence instruction can be given to them only in the evening.

With this object it was decided to institute for the advanced courses hitherto given by the Lowell Institute, under the auspicies of the Institute of Technology, an evening "School for Industrial Foremen," open, free of charge, to young men who are ambitious and well fitted to profit by the instruction. The term "foremen" is used in its broad meaning.

The school comprises two courses, one mechanical and the other electrical, and each extending over two years. The work of the school at the outset was practically the same as it is today.

The courses are intended to bring the systematic study of applied science within the reach of young men who are following industrial pursuits and desire to fit themselves for higher positions, but are unable to attend courses during the day.

The schedule of the courses is as follows:

FIRST-YEAR COURSE

	Hours
Mathematics	56
Physics	33
Electricity	28
Mechanism	34
Drawing	40
Total	192

The schedule for the first year is the same for both the mechanical and the electrical courses.

SECOND-YEAR MECHANICAL

	Hours
Elements of thermodynamics, the steam engine and boilers	38
Valve gears	10
Applied mechanics	38
Elementary hydraulics	10
Testing laboratory (resistance of materials)	12
Steam and hydraulic laboratory	24
Mechanism design	12
Elementary machine design	60
Total	204

SECOND-YEAR ELECTRICAL

	Hours
Elements of thermodynamics, the steam engine and boilers	38
Valve Gears	10
Steam laboratory	16
Direct-current machinery	12
Alternating currents	22
Electric distribution	30
Electrical testing (laboratory)	24
Laboratory of dynamo electric machinery	48
Total	200

It may be supposed that men who are following industrial pursuits during the day are not in a condition to receive instruction after their day's labor, and that the instruction under such conditions can be of but little profit; but it can be safely stated that such is not the case.

It has been also thought by some persons that the amount of work attempted in the two years was too large. To be sure, the courses are severe, and there are at present not a large number of men who are capable of following them; but, the courses are not planned to reach the greater number of men. They are designed to give training to that group of picked men who are able to profit by the instruction and who will be able through it to advance to higher positions. For the eight years of the school's history about as many men have been able to keep up with the work as the capacity of the school would admit. It is believed that with the facilities at hand it is of greater value both to the men themselves and to the industrial community to give this high standard of training to a comparatively small number of men, training that will fit them for positions of foremen and superintendents, rather than to give training of a lesser degree to a larger number of students.

The average yearly attendance has been about 200 students, 125 in the first-year class and 75 in the second-year class. One hundred eighty-nine men have been graduated and 30 of this number have attended the school a third year and are graduates of both the mechanical and the electrical courses. The men have come from about 75 different towns within a radius of 20 miles, and a few men from distant cities have taken up work in Boston in order to attend the school.

A great variety of occupations have been represented, but about half the number of students are draftsmen or machinists. The oldest man to attend was 54 years of age, and the youngest man 17 years. The average age of the students at the end of the first-year course varied from 28 to 24. The average age of the graduates has varied from 29 to 25 years. A few men have graduated who were older than 40 years, and a number have graduated at the age of 19.

The earlier schooling of the men who have completed the first-year course has averaged as follows: College graduates, 4 per cent.; attending college, 9 per cent.; high-school graduates, 46 per cent.; attending high school, 25 per cent.; grammar-school graduates, 13 per cent.; attending grammar school, 3 per cent. It will be noticed that, although a few more than one-half the students have been high-school graduates, or better, a considerable number of the men have entered the school with but very little earlier schooling.

That the school is making the men more efficient in their regular occupations, and qualifying them for advancement along the lines in which they are

*Abstract of paper presented before the Congress of Technology.

†Associate professor of mechanical engineering, Massachusetts Institute of Technology; director of Lowell Institute School for Industrial Foremen, Boston.

working, has been demonstrated by the graduates. Nearly all of these men have changed their occupations or have advanced to a higher grade in the same line of work.

There are but few exceptions to the rule that a good workman gets better pay than a poor one. The following facts have been compiled from answers to a circular letter received from about three-fourths of all the graduates:

Average Increase of Salaries

Two years after graduation, more than 70 per cent.; class graduated in May, 1910, 72 per cent.; from three to six years after graduation, 107 per cent. A considerable number of graduates have received increase of salaries greater than 200 per cent., several men have received more than 300 per cent., and one man had an increase of 450 per cent.

Limitations of Scientific Efficiency*

By Henry G. Bradlee

During the past year much has been said and written about " efficiency," and, in fact, quite recently the public was startled by the statement that the steam railroads of this country are wasting a million dollars a day—three hundred and sixty-five million dollars a year—which might be saved through the adoption of so called scientific methods of management.

This whole question has recently jumped into prominence because a group of men who have been doing some very excellent and successful work, have been tempted into the realm of prophecy, and have possibly allowed their enthusiasm to outstrip their judgment.

In view of the statements which have been made it certainly seems reasonable to consider whether there are not some practical limitations which have prevented a general adoption of these methods in the past and which may prevent the wholesale overturning of present industrial systems.

Fundamentally Not New

Stripped of technicalities the method of the modern efficiency engineer is simply this. First, to analyze and study each piece of work before it is performed; second, to decide how it can be done with a minimum of wasted motion and energy; third, to instruct the workman so that he may do the work in the manner selected as most efficient. There is nothing fundamentally new in this method. The underlying principle is being used today to a greater or less extent in all industries and has, no doubt, been used at all times in the past.

The method as employed by the modern efficiency engineer is distinctive, not because it is new, but because it is carried to much greater detail. He is not content to plan work along broad general lines, but proposes to attack it in a more scientific spirit and obtain maximum efficiency through preventing waste and loss at each and every point. With this in view he watches every motion of the workman's hands and body. If any unnecessary movement is made he tries to change the conditions under which the work is carried on or gives instructions to the workman so that the wasteful act may be avoided in the future.

Some Factors to be Considered

The form of organization adopted naturally has the same end in view. The number of overseers, supervisors, experts and specialists, in proportion to the number of workmen, is materially increased. Special accounting systems are adopted to show at a glance what proportion of the cost of a piece of work is necessary and what proportion is caused by wasted energy. The information so obtained is used as a guide to prevent waste in the future. The workman is often encouraged to coöperate through the use of a bonus system which aims to give the highest pay to the most efficient worker.

These methods in certain cases have produced surprising and satisfactory results, but it is by no means a necessary conclusion that they can be universally applied with equal success.

Upon considering these methods of careful study and analysis, and of detail instructions to workmen, one is first impressed by the fact that such study and instruction must be expensive; it must be performed by men of considerable ability, and consequently high pay, otherwise it will not be effective. Such methods, therefore, can be used to advantage only where a material saving can be made.

If a piece of work is to be performed but once the manner in which it is to be done may be planned in a general way, but should one attempt before starting the work, to decide the exact manner in which every detail is to be handled the cost of planning may exceed any possible saving in the cost of labor. If the work is to be repeated several times, but each time is to be performed under new conditions, the same difficulty will be found. On the other hand, if the work is to be repeated a number of times under uniform conditions, instead of only once, it may be profitable to carry out the preliminary planning in greater detail, but not until the work is to be repeated over and over again should the full program of the efficiency engineer be adopted.

Next, consider the territory covered by the work of any industrial organization. Imagine a factory employing a thousand men under a single roof. Then imagine an industry employing an equal number of men distributed through forty different cities, an average of twenty-five men in each city. Can there be any doubt that the introduction of the methods of scientific efficiency would be fraught with a hundred difficulties in the second case for every one in the first?

Methods Sometimes Unbalanced

Any attempt to increase economy in one detail of operation often decreases it in another. This may be illustrated by the fact that one of the first steps taken by an efficiency engineer is to establish an elaborate system of cost accounting; a second step is to increase the number of supervisors and specialists employed to oversee and direct the work of the laborers. This increased cost is deliberately and intentionally incurred for the purpose of saving a greater amount in other items of expense. If the accounting department were considered by itself without reference to the rest of the business, or if the number of supervisors and specialists were compared with those employed by some other concern doing a similar business, it might appear that the efficiency engineer is most extravagant and uneconomical. However, to be fair and just to the engineer, one must consider the results of his work as a whole and not condemn him because of increased expenses in certain departments.

"Penny Wise and Pound Foolish"

It has always been recognized that there is an element of danger in fixing one's attention too closely on detail economies, which is in line with the "man who was penny wise and pound foolish." The writer once knew the manager of an electric lighting company who directed his business with the greatest economy. He frequently remarked that he would much rather save a dollar in operating expenses than secure a dollar of new business because, when he had saved a dollar in expense he had saved the whole dollar, but, when he had obtained a dollar from new business he had to spend half of it in serving the customer. In due course of time this manager resigned and a new man was appointed in his place. The new manager was not very economical, but he was a hustler for new business and he kept in very close touch with his customers. As a result the business immediately began to grow and increased very rapidly, and the public received more and better service at slightly lower rates. The dividends of the company increased, but the cost of operation per kilowatt-hour increased also. Measured by operating costs only, the efficiency was less than under the old manager, but the efficiency of the business, as a whole, was greatly increased.

*From an address delivered before the Congress of Technology, and also the National Association of Cotton Manufacturers.

Letters from Practical Men

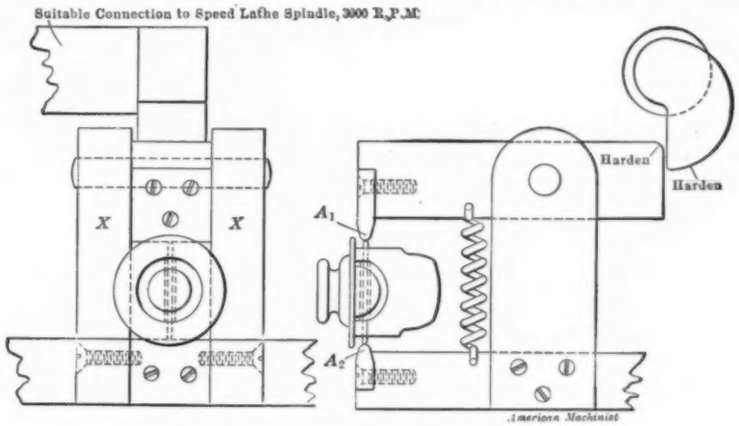
Concerning the details of making things in machine shops, from the first sketch to the shipping room. A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

Riveting in the Lathe

In the accompanying line cut is shown a device which I used to rivet several thousand of the pieces illustrated. The device worked wonders in the saving of time over the hand-riveting method, since the wire to be riveted was so small that it would not stand a very heavy blow, such as an ordinary boy might give it with a flat peen hammer.

The sketch explains itself; the two side uprights XX' support the freely swinging crossbar, to one end of which is secured, as shown, the hardened riveting point A_1. The fly cam, which is mounted in the spindle of a speed lathe, depresses one end of this bar and as it passes out of contact the spring pulls the bar down and strikes a blow on the end of the rivet. The anvil is stationary and also has a hardened point A_2.

Suitable gages were provided to prevent putting the pieces into any but the right places; the strength of the blow was determined by trial and a suitable spring provided. The device was secured to the lathe bed with suitable clamps.



SPEED-LATHE RIVETING DEVICE

Buffalo, N. Y. F. C. LE MESSURIN.

Assembling Fixture for Object Finder on Cameras

The illustrations will give the principle and the use of this fixture. Fig. 2 is the object finder and with the three parts to be assembled I will explain first:

We have a bottom, top frame and lens. The bottom frame has four ears A, which go through the slots B in the top frame, the lens is placed in between the top and bottom frames and the ears of the bottom frame are bent outward and clinched.

The principle of the fixture is this: The first movement of the cam downward advances the shaft, and brings the tension block to the lensmount with pressure. As the cam advances the lower part of the cam operates on the collar F, pushes the four punches down and bends the ears over the top frame as is shown in Fig. 2.

The base A is finished cast iron, the shaft bearing B is bored, counterbored and a slot milled on one end to fit a tool-steel piece. The shaft C is machine steel turned down on one end and the other end left large. Shaft head E is bored out to fit a tension block R and the small end of the shaft is slot milled part way, to fit the double cam D and camplates G and H for a sliding fit.

The double cam D is somewhat peculiar, having a double action in operation. The cam pulls the shaft C down until the tension block R has given a certain amount of pressure to the lensmount. The lower part of the cam will move collar F, with the punches T, and bend the ears over, thus tightening the lens.

The shaft head E, in which four holes are drilled and reamed, in line with the four holes in collar F, is also bored to fit the tension block R.

The springs I, J and K are of music wire. I holds the whole shaft in place, J supports the collar with punches, K is a tension spring acting as a pressure upon R.

Washer L is the spring support which is held by a screw M. The camscrew N

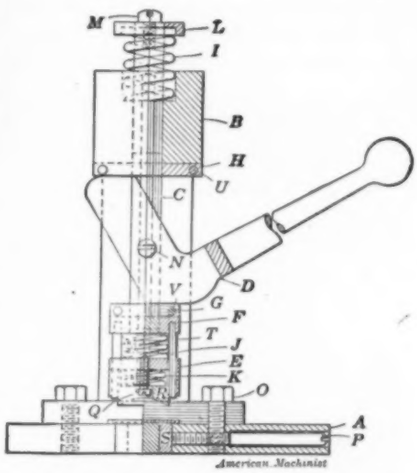


FIG. 1. ASSEMBLING FIXTURE FOR OBJECT FINDER ON CAMERAS

is hardened and ground, the capscrews O hold the parts of A and B together. The setscrew P holds the lensblock S in place, Q is the tension block screw.

The tension block R is of tool steel and must have a good finish, so as not to spoil the nickel-plated frames. The lensholder S is tool steel and has, also, a good finish for holding the frames with lens in position.

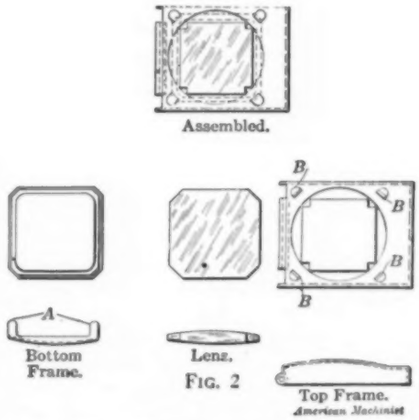


FIG. 2

LENS MOUNT WITH LENS

The punches T are hardened and slide through E and are tight in F. The taper pins U and V hold the camplates in place.

Rochester, N. Y. E. F. JOSE.

The Mirror and the Pyrometer

There are different ways of adapting things for one's use. Take the mirror for instance. The dentist uses it in his business, in fact, he could not do business without it; the toolmaker uses it in conjunction with his other tools to complete a job; surgeons and specialists all use the mirror in some form or other, and one might say almost all the trades and professions have a distinct use for the mirror. You see it in churches and in lodge rooms where they have an organ, to allow the organist to see what transpires back of him, and it was in lodge that I got the idea of using a mirror on a pyrometer, an idea which I believe is original.

MIRROR FITTED TO PYROMETER COVER

Some pyrometers are fastened on the wall or any place convenient for the operator to read and others are set horizontally on a post or block, usually some distance from the furnace, which necessitates a trip to the instrument to get the reading and means several steps both ways, besides consuming time that should be spent at the furnace. My pyrometer is set directly back of and a little to the right of the furnace and was so placed before I took charge of the room. However, I soon got tired of trotting around to read the pyrometer and puzzled my brains how to overcome it. Well, I went to lodge one night, and looking toward the organ my eye struck the mirror, and instantly the idea presented itself, and I made up my mind to try it out. I figured that it would take two mirrors to do the trick, but I soon discovered that one was enough, so the next morning I fixed it up and it has been there ever since, and it has saved me a good many miles of walking.

The accompanying halftone shows the position of the mirror at the back of the box inclosing the instrument, and held at the proper angle by strips of brass on each side, being fastened to the glass cover of the box, so that on raising the cover to adjust the instrument the whole thing moves with it. The light is plainly seen, also the reflection of it, and it is put on the outside for the reason that the light generates so much heat on the inside that it affects the level (liquid) of the instrument.

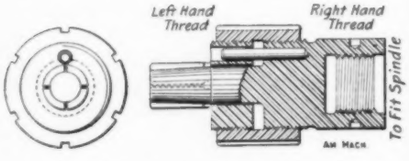
The light is operated by a hanging push button over the operator, so that he can operate it at his own convenience without moving a step, and the switch that may be noticed at the front of the box is for operating another furnace.

I would suggest to whoever tries it to get a mirror of good quality.

Decatur, Ill. GEORGE COLES.

Expanding Mandrel

A mandrel of the type shown in the cut is very handy for numerous jobs, such as cutting off piston rings and turning work of all kinds. The spanner nut has a right- and left-hand thread which makes it operate quickly. The mandrel could be made with a taper shank to fit in the lathe center, or threaded to fit spindle.



EXPANDING MANDREL

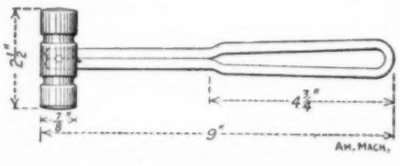
This type of mandrel was formerly made with a key, but has been discarded for the pin as shown, and we find that it gives a great deal better satisfaction.

If the expansion part of this mandrel is made over 1½ inches diameter, would advise splitting it into more than four sections. The taper should be about one inch per foot. We find that this mandrel gives just as good satisfaction made of mild steel, as if it were made of tool steel.

Athens, Penn. R. B.

A Brass Hammer

The accompanying cut shows how a brass hammer can be quickly, cheaply and neatly made. A piece of brass of the desired size, and about 18 inches of ¼-inch cold rolled are all that is necessary. The cold rolled is formed into a handle and two ¼-inch holes are drilled close to the center of the brass head. The handle is driven into these holes and a pin put crossways through the center, which completes the hammer.



A BRASS HAMMER

Rockford, Ill. CARL G. OLSEN.

A Base for an Inside Micrometer

The accompanying cut, Fig. 1, shows a steel attachment that I made for holding my Starrett inside micrometer for use as a hight gage, and I think this is better than any on the market, because it holds the micrometer perfectly square.

As shown in Fig. 2, the base is bored to take the split bushing and this bushing is bored to fit the micrometer head.

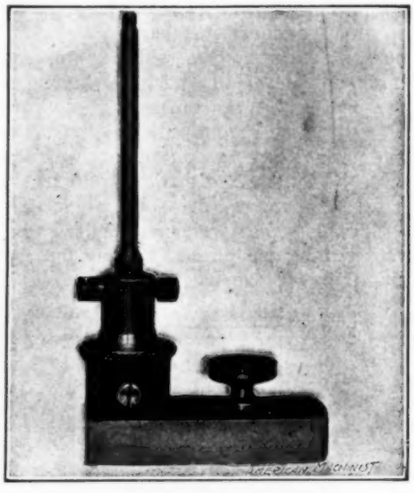


FIG. 1. INSIDE MICROMETER USED AS A HIGHT GAGE

FIG. 2. DETAILS OF BASE FOR INSIDE MICROMETER

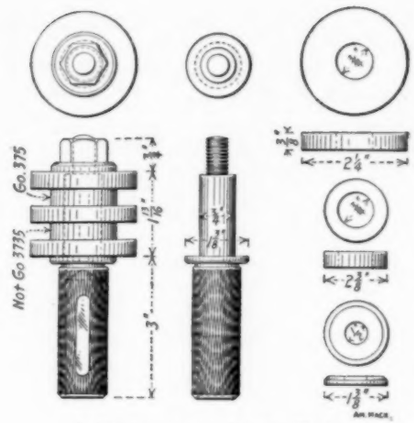
The tip is removed from the micrometer head, as it is ground round and will wear out in a short time, and is replaced by another as shown, which is much larger and has a flat head, which is hardened and carefully lapped so as to measure the standard size.

Elizabeth, N. J. HANNIBAL YOTTA.

A Piston Ring Limit Gage

The accompanying cut shows in detail a piston-ring limit gage, used for measuring the width of automobile engine piston rings, which is easily made accurately and of any desired size.

As the cut shows, the gage consists of a handle ground like a mandrel on one end and threaded for a nut. Over this mandrel is first slipped a hardened and



A Piston-ring Limit Gage

ground gaging ring, then a spacing collar; another ring; another collar and then a third ring, all being held firmly on the mandrel by a nut and washer.

The convenience and ease with which one of these gages is used, when well made, is a revelation to those used to the snap-gage type.

St. Paul, Minn. J. D. M.

An Accurate Drill Jig

Fig. 1 at *L* shows a jig for drilling a pin hole in the hub of the gear *A*.

The hole for the pin *B* must be a positive distance from the other end of the hub of *A* and must also be in a positive position with relation to the keyway *C*. The over-all dimensions of the hub of *A* are immaterial, so that the time is wasted in producing accuracy at this point.

The stud *D* is fixed in the body of the jig *L*, which is recessed to take the front end of the hub, as it is shown in the halftone. The key *G* locates *A* in one position and after *A* is in place the washer *E* and the nut *F* are put on the stud and *E* is screwed hard up against the shoulder *K*, which bears against the back of the gear *A*, as shown in the halftone. The shoulder *K* is an absolute distance from the two drill bushings, which are located one on top and one underneath the jig *L*, behind the feet *I*. When the gear *A* is in place, as shown in Fig. 2, there is a certain amount of play between the washer *F* and the face of the hub.

Referring again to Fig. 1, two pins *H*, 180 degrees from each other, are a sliding fit in the body *L* and reach through into the recess into which the hub projects. The nurled nut *J*, when screwed up, forces these pins against the hub of the gear *A*, seating it against the washer *E* and locating it accurately for drilling the pin hole. This jig is in use in the shops of the Light Foundry and Machine Company, Pottstown, Penn., for drilling gears for the Stevens-Duryea car.

New York. E. A. Dixie.

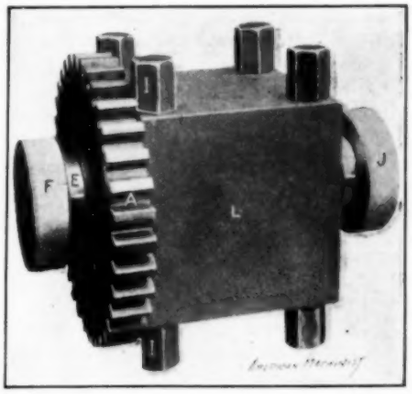


Fig. 2. The Work in Place in the Jig

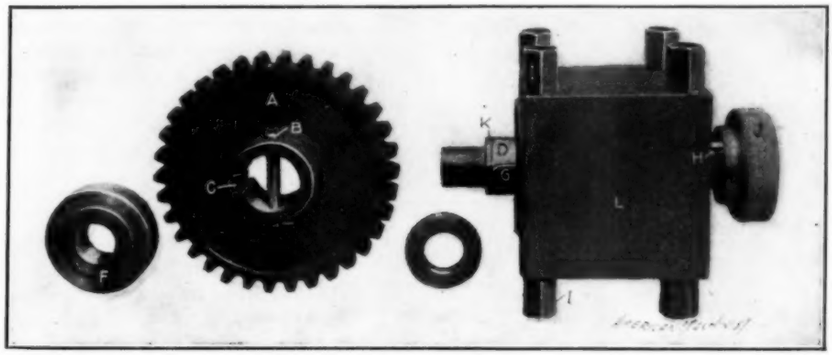
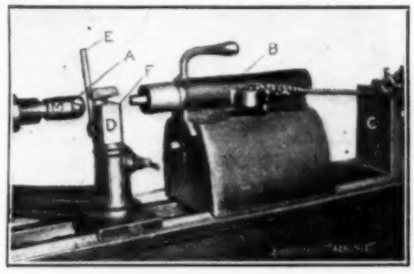


Fig. 1. The Jig and the Work

Rivet Spinning on a Lathe

Occasionally we have small quantities of work to rivet, and in the past we have always riveted by hand, which was slow and gave an unfinished appearance, but recently we made fixtures for an old speed lathe, as shown in the halftone. This device takes but a short time to attach to the lathe and for lots of work answers just as well, if not better, than a high-priced special machine, and besides when not in use for spinning, the machine is used for lathe work. The cut shows the spinning wheels *A*, whose mounting *M* fits the headstock spindle.

The tailstock spindle *B*, which slides back and forth, bringing the work up against the spinning wheels, is operated by a lever *C* with a treadle to bring it forward and a spring *S* to pull it back. *D* is a work clamp operated by lever *E*, and *F* is the recessed anvil used to hold the stud while the first head is being spun and which also regulates the amount left to spin the second time; then after all are spun on one end, a crowning anvil is substituted and the other end riveted down tight.



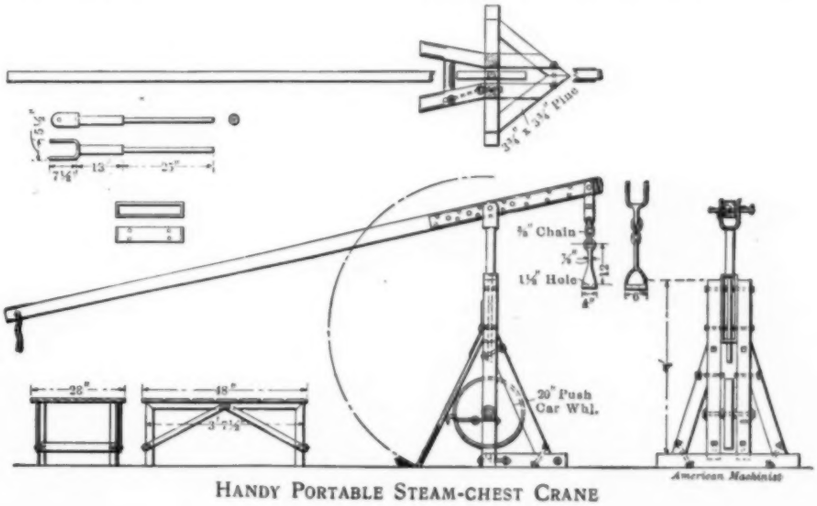
Rivet Spinning in a Lathe

With this device fast and good work can be accomplished for a small outlay.

R.

Steam Chest Crane

Some roundhouses and shops without crane facilities have experienced considerable difficulty in removing steam chests from locomotives. The accom-



Handy Portable Steam-chest Crane

panying drawing shows a handy portable lift for this work. The long lever of the lift is removed by pulling out the pin and the stand is folded up by unhooking one side and closing the hinge. The long lever can then be carried while the stand is rolled on the wheel. The bench shown in connection with this device, while not a part of it, has proved quite serviceable in making repairs to steam chests. This lift, used on a large railroad, proved a timesaver and a great convenience for the machinists.

New York, N. Y. C. J. MORRISON.

Root Diameters of Threads

I have met so many machinists who either never knew the formula for figuring the diameter of a screw at the bottom of the thread or else have used it so seldom they had forgotten it, that, I am sending a table which can be tacked on the wall or pasted inside the cover of a tool box where it is always accessible at a minute's notice.

Draftsmen will find it very useful too, in fact a draftsman first gave it to me.

The table not only gives the constant for each pitch, both for United States Standard and V threads, but gives the formula.

Providence, R. I. L. E. MIDDLETON.

Threads per Inch.	U. S. S. Thread.	V Thread.	Threads per Inch.	U. S. S. Thread.	V Thread.	Threads per Inch.	U. S. S. Thread.	V Thread.
3	0.43333	0.57733	10	0.12990	0.17320	26	0.04996	0.06661
3½	0.37114	0.49485	11	0.11809	0.15745	28	0.04639	0.06185
4	0.32475	0.43300	12	0.10825	0.14433	30	0.04330	0.05773
4½	0.28866	0.38488	13	0.09992	0.13323	32	0.04059	0.05412
5	0.25980	0.34650	14	0.09278	0.12357	36	0.03608	0.04811
5½	0.23618	0.31490	16	0.08118	0.10825	40	0.03247	0.04330
6	0.21650	0.28866	18	0.07216	0.09622	44	0.02952	0.03936
7	0.18555	0.29742	20	0.06495	0.08660	48	0.02706	0.03608
8	0.16237	0.27650	22	0.05904	0.07872	50	0.02598	0.03464
9	0.14433	0.19244	24	0.05412	0.07216	56	0.02319	0.03093

C = Constant.
D = Outside diameter.
D' = Diameter at bottom of thread.
P = Pitch or No. of threads per inch.

$D' = D - C$ $\quad C = \frac{1.732}{P}$ for V threads

$C = \frac{1.2990}{P}$ for U. S. standard thread

TABLE OF CONSTANTS FOR FINDING DIAMETER AT BOTTOM OF THREAD.

[As the table omits 11½ threads, it gives a good opportunity to apply the formula, $C = \frac{1.732}{11.5} = 0.150$ for V-threads, and $\frac{1.299}{11.5} = 0.1129$ for U. S. S. threads.—ED.]

Number of Teeth in Worm Wheel Hobs

The accompanying table, compiled from experience in the manufacture of hobs for worm wheels, gives the number of grooves to be milled in the hob to form the cutting teeth. In the form shown it is applicable to single start (single thread) hobs, but it may be used for hobs with multiple threads by observing the following three rules:

(a) On hobs of two or three starts use the number of teeth given in the table.

(b) On hobs of four to six starts use one less tooth than the number shown in the table.

(c) In multiple-thread hobs the number of teeth must be modified so as to make them "prime" to the number of starts.

To illustrate rule (a); from the table the number of teeth in a hob having three starts, ⅜-inch pitch, 3-inch diameter is 12. This is not prime to the number of starts.

At the bottom of the table is given the total rise of the cam used for relieving the teeth. This cam rise gives a fair relief for hobs of one and two starts. For hobs of three to six starts the next size larger cam should be used. The reason for this increase of relief on multiple start holes is that the variation in helix angle between point and root is generally more pronounced in multiple start worms, as they are invariably of greater pitch angle.

J. BUTTERWORTH.

Leeds, England.

Outside Diameter of Hob in Inches.	Pitch of Hob in Inches.									
	⅛	¼	⅜	½	⅝	¾	⅞	1	1¼	1½
1	7	5								
1¼	8	7	5							
1½	10	8	6	5						
1¾	12	9	7	6	4					
2	12	10	8	7	5	4	4			
2¼	13	11	9	8	6	5	5			
2½	13	12	10	9	8	5	5			
2¾	14	13	11	9	9	6	6			
3	14	14	12	10	10	7	6	5		
3¼	15	14	13	11	10	8	7	6		
3½		15	14	12	11	9	8	6	5	
3¾		16	15	13	12	10	9	7	6	
4		16	15	14	13	10	9	8	7	6
4¼		17	16	15	14	11	10	9	8	6
4½		17	16	16	15	12	11	9	8	7
4¾			17	16	15	13	11	10	9	7
5				17	16	14	12	11	9	7
5¼					17	15	13	12	10	8
5½						16	14	12	10	8
5¾							15	13	10	9
Rise of relieving cam (inches	0.08	0.12	0.16	0.16	0.2	0.2	0.24	0.24	0.28	0.28

NUMBER OF TEETH IN SINGLE THREAD HOBS.

System of Pattern Numbering

The Scottdale Foundry and Machine Company furnishes a very satisfactory system of pattern numbering. The pattern numbers are the drawing number plus letters *A, B, C,* etc. This simplifies records, avoids confusion in pattern numbers and saves in the number of data to be put on a general drawing, because if the drawing number of a piece is stated, the pattern number is known and *vice versa.* This system is elastic also.

I developed an almost identical system three years ago, but extended it to include forgings and all kinds of material, using the prefix "Mark" on patterns as well as on other material. When a piece is redrawn, or retraced on a different drawing, it gets a new mark and a reference to the old drawing. I also put the weight on the tracing, sometimes using red ink when it is better not to have the weight show on the print.

Scottdale, Penn. F. D. BUFFUM.

Graduating Shaper Vises by Inches

A suggestion which I recently heard offered was to graduate one of the steel jaws in shaper vises in inches, so that if for any reason a piece of work was removed from the vise before being finished, the position could be noted, and the piece could be replaced in the same position, thus insuring its being in the space covered by the travel of the tool, and preventing the necessity of changing the stroke or moving the work.

M. L. R. FOOTE.

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

Drilling Cast Iron

George H. Handley asks, on page 700, for further particulars about the drilling of 91 one-inch holes in 27 minutes. The tank weighed 6675 pounds, the machine was a 6-foot Bickford radial drill extended to 7 feet, and steel gearing substituted for cast iron.

I think the drill was a Celfor, the speed 290 revolutions, and the feed indicated on the machine as 64/1000 inch, and as the drill began to come through, it punched out a washer. If this drill had been ground as drill makers grind them I think the job would have required three times as long; or by a mill-fluted drill, for lack of chip room, as the chips came boiling out like water out of a fountain.

The other day I timed the men drilling 7/8-inch holes through 1-inch flanges, and they were doing them at the rate of 11 seconds each, moving the radial arm and head to get from hole to hole, one man swinging the arm and the other running the head, bringing down the spindle and throwing in the feed. All the holes in the jig were bushed. In the case of the 91 holes, a prick mark was the only guide, as there was nothing particular about the job. The point is that we can make more money with two men operating the machine than with one.

Syracuse, N. Y. E. E. T.

Blueprint Records

With regard to the article by I. C. Hall on the above subject, which appeared on page 358, I am inclined to think that the following system of keeping track of blueprints is still simpler and just as effective as the system he advocates; moreover, I have seen it in use in several large drawing offices, some of them having between ten and twenty thousand drawings, and in every case, without exception, it has been found to work well.

The system is best explained by a glance at the illustration. This represents a drawing and, as will be seen, there is added a small table in which are noted the departments to which prints have been sent with the date of sending (P. S. St. and M. S. standing for pattern shop, stores and machine shop, respectively), so that the drawing itself has a record of all prints issued.

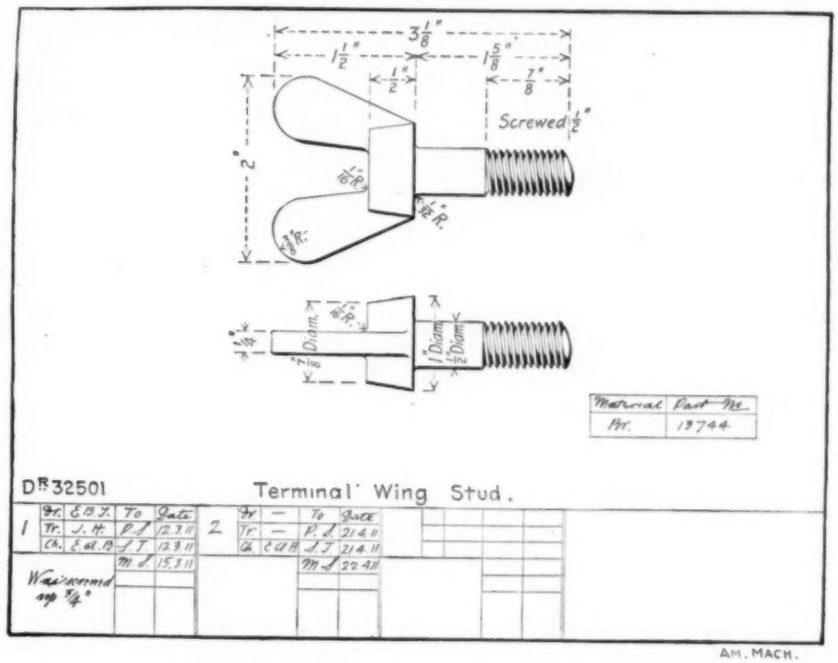
The drawings when issued are on subnumber 1, and when altered are given a new subnumber, the alteration being noted under the original subnumber; all old prints are recalled and new ones issued on subnumber 2. Should a further alteration be required at some later date, then the process would be repeated and the drawing would become subnumber 3.

There is one point which should never be overlooked when altering drawings, and that is, if the necessary alteration in any way affects the interchangeability of the part, then the drawing should not be altered; but a new drawing made with a new number or, to save time, if the alteration is only a slight one, prints can be taken from the original drawing, altered and given a new drawing number. Then one of the prints may be filed as the original of that number.

Moreover, in small works employing up to about 500 hands it is, as a rule, quite unnecessary to have any blueprint-record system, because one copy, and only one copy, of every detail drawing is issued to the shop blueprint store room for the use of all the shop departments. Also only one copy of all drawings relating to patterns is issued to the pattern shop. In this way everyone knows if one or two prints are issued, according to whether or not the drawing relates to pattern work.

L. NIKCUL.

Chelmsford, England.



DRAWING WITH PRINT RECORD INCLUDED IN ITSELF

The Taylor System as a Machinist Sees It

I am very interested in your article about Mr. Taylor and his speeding-up system, and I thought perhaps a few facts would be interesting, and these I can give, as I was recently employed in one of the machine shops of the Bethlehem Steel Company.

In one shop when a man gets a job to do he is allowed a certain length of time to set it up in, a certain length of time to shift it, and then a certain length of time for each cut. If he can finish the job in less than the actual time, he receives a bonus. These bonuses run from 30 cents to $1 a day.

One day I went down to one of the large boring mills and watched it run. I saw that it was not taking off quite as large a chip as Mr. Taylor might desire, so I asked the machinist on the job if he had made his bonus.

"Oh, yes," he said, "but I have to slow down a while now; you see I'm ahead of the job already, and if we make too much bonus they will cut us down."

Now, Mr. Lewis or anyone else, would

a fairly-paid machinist ever say anything like that?

Mr. Taylor has done a wonderful thing for the Bethlehem Steel Company, but there is more than one way of driving a man, and the bonus system is certainly one way.

When Mr. Lewis said: "Nothing could be further from Mr. Taylor's idea of good management than the driving system referred to in the article by Mr. Fitch," did he know that the man who handled 47½ tons of pig iron in a day was earning a bonus, which helped to raise his 12½ cents up to a figure which hardly supplied a large family with food?* Now Mr. Lewis, is this driving?

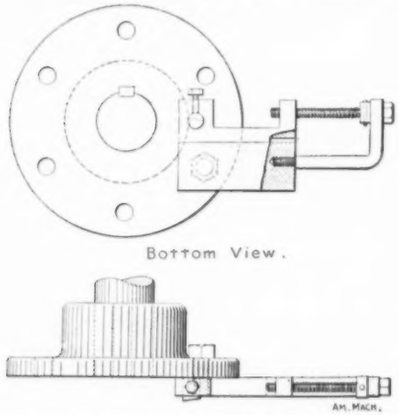
Mr. Taylor is a great man and he has developed a wonderful system, but if Mr. Lewis or anyone else should ever work under it, he would possibly learn that there is more than one way to drive a man.

Altoona, Penn. F. H. DWIGHT.

Truing a Coupling in Place

Some time ago a method of truing up a coupling, in place on its shaft, was given in these columns. The following is a description of the method I used to get over a similar difficulty.

In this case the coupling on a jackshaft



DEVICE USED IN TRUING COUPLING ON SHAFT

worked loose and having been neglected too long it chewed the keyseat so badly as to necessitate the cutting of a new one. The jack shaft is in the wheel pit connected direct to a 60-horsepower turbine which is used as an auxiliary to a steam engine, and forms, by means of two belts the connecting link between two line shafts. After having cut a new keyseat and fitted a new key the coupling was naturally somewhat out of truth on the face.

As there was a 1-inch distance between the turbine and jack-shaft couplings and both shafts had bearings close up to the couplings this gave me a chance to true it up. I made the tool shown in the illustration from a slab of cast iron 4 inches by 6 inches by ⅞ inch found in the junk heap. I parted it through the middle, grooved one and dovetailed the other to fit it, a good sliding fit, and otherwise finished it off as per illustration.

To use it, I clamped it to the turbine coupling by means of a set screw through one of the bolt holes and put a prop under it to the floor; then I had the engine turn the shaft slowly and very easily finished the job.

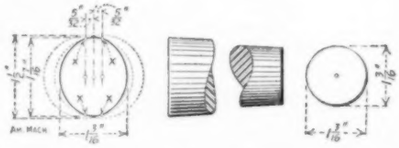
After truing up one coupling I found the turbine one also needed it so I transferred the tool to the other coupling and by admitting only a little water and braking the speed down with a belt over coupling and a board as a lever I was able to finish the job satisfactorily.

Winsted, Conn. R. W. HUTTON.

*The original amount of pig iron handled was 12½ tons per day for which the workmen received $1.15. Ultimately, the amount was raised to 47½ tons per day for which the wages paid were a little more than $1.85. —ED.

Oval Turning on the Engine Lathe

On page 650 D. C. King asks how to turn an oval wagon spoke on the engine lathe. The inclosed sketch shows a



OVAL TURNING ON THE ENGINE LATHE

method by which this could be done where a small quantity is required.

Lay out and drill three center holes in the end to be oval, as shown, set the taper attachment ¼ inch in 26 inches and turn the piece to size, 13/16 inch and 1 7/16 inch, respectively, using the middle center. Next change to taper to 5/16 inch in 26 inches and move to the other center holes. This will cut on one side at a time only, forming an approximate oval.

The slight corners at *X* are readily removed with sandpaper while revolving at high speed in the lathe.

I have turned hammer handles very satisfactorily by this method in an ordinary woodturning lathe.

Rockford, Ill. CARL G. OLSON.

Taking Suggestions From Down the Line

I have been reading the advertising story "The Redeemed Factory" and was reminded how often we see men of the Dickson type.

To my mind, if the foreman, superintendent or even the employer would listen to the plain workman instead of turning him down, it would be to the best interest of the factory, and often prevent things running at a loss.

The suggestion-box system is often dismissed as a failure but if carried out honestly and diplomatically it can be developed into a genuine asset.

New York. LOUIS KRUGER.

Foreign Tariff Work of the Bureau of Manufactures

The Bureau of Manufactures of the Department of Commerce and Labor is planning to make its foreign tariff work more directly helpful to manufacturers and exporters of the United States. It possesses exceptional facilities for supplying the latest exact information concerning tariff rates and the customs formalities incident to the entry of goods into foreign countries. In addition to the latest official customs tariffs of nearly all foreign countries, customs decisions and other official publications to the number of a thousand a month are regularly read and filed to keep the tariffs fully up to date. The tariff publications of the Bureau, which are being extended as rapidly as possible, now fall into the following general classes:

1. The translation and publication in pamphlet form of the entire customs tariffs of particular countries with such explanatory matter as seems desirable. The customs tariffs of Germany, Italy, France, Mexico, the United Kingdom, Australia, New Zealand and several other British colonies have already been published.

2. The publication in similar form of rates of duty of all countries on particular classes of commodities—for example, leather and leather manufactures, agricultural products and machinery of every description. Similar pamphlets give the regulations governing commercial travelers abroad and the consular regulations of all foreign countries.

3. All proposed and recent changes in rates or regulations of foreign countries that affect imports of merchandise from the United States are given publicity through the columns of the Daily Consular and Trade Reports immediately upon their receipt, and for convenience of reference are assembled and issued separately, as often as is deemed necessary, under the title "Foreign Tariff Notes."

A list of individuals and firms engaged in foreign trade is being formed, showing the articles of merchandise and the countries in which each is particularly interested, with the two-fold object of keeping exporters fully informed of all tariff changes abroad and of selecting for immediate treatment the subjects that will prove most generally helpful. In order to facilitate the compilation of such a list, a circular letter is being sent out to the trade, and copies may be obtained from the Bureau of Manufactures.

Distribution of the Expense Burden *

By A. Hamilton Church†

What I have to say to you really involves a new way of looking at the facts of production, and consequently of the whole question of shop statistics and costs. This new point of view is the outcome of the results of a study of expense burden over a number of years, and I have to offer to you not so much a specific system of record, as a set of principles, the practical application of which can be and indeed must be varied and adapted to suit individual cases.

I advocate a method of charging the hourly operation cost of machines by what I term machine rents, which differ from the old arbitrarily fixed machine rates. The machine rate as ordinarily employed was an attempt to give expression to the obvious physical differences between machines, and to bring an element into costs that would reflect this difference. But these old machine rates were, for the most part, arbitrarily fixed, and not based on anything like a complete survey of the facts of shop production. Usually, in fact, they expressed only the capital value of the machine. They failed to solve the problem, because they took account of *some* and not *all*, of the immensely varied items of the expense burden.

Cost of material is left entirely out of this discussion. In the early days of manufacturing industry, attention was not so much concentrated on doing things economically as with the much more difficult problem of doing them at all. The story of Nasmyth's invention of the steam hammer in response to a sudden demand for a machine that would forge the crank shafts of ocean steamships is a case in point. And a good deal of the history of industry during the last century consists of similar incidents, less striking in themselves, but each resulting in a new triumph over natural obstacles and becoming the starting point of a whole range of new progress in other industries.

Operation Costs Overlooking

I believe that this is the reason why the perfectly obvious idea of taking out the operation costs of machine tools was overlooked by the early manufacturers. To them, the operation cost of a new kind of machine was a small matter compared with the fact that it enabled them to do something that had never been done before. In other words, the progress of the last century was almost wholly in the direction of promoting technical development . . . . leaving to us, of the present day, the almost equally interesting task of increasing economic efficiency.

There is another reason why the natural idea of taking out machine-operation costs was overlooked. It is only within a comparatively recent period that the question of costs began to force itself on the attention of engineering manufacturers . . . . the older school were in the happy position of being able to satisfy themselves by a glance at their bank books that they were all right. I am afraid that those halcyon days have passed. Increasing competition and the diminution of the margin of profit, to say nothing of the necessity of minutely studying operations, have for some time past made it imperative for manufacturers to look into the cost of their product and I think it will generally be found that the most successful firms are those that have looked into it most closely.

By the time that the urgent demand for knowledge of costs began to be felt, manufacturing has already assumed a high degree of complexity of organization, and the fundamental mistake made by the early cost men was that in observing the complex activities of a busy machine shop they analyzed the wrong things. They analyzed figures instead of analyzing the facts that lay behind them. Had they, instead of dealing with book values, gone behind these and endeavored to undertake for what specific economic purpose each item of expense has been incurred, the machine-rent method which I present would have been born a generation ago.

Passing the Tool Point

I hope you will agree with me that the salient feature in machine-shop activity —the end toward which it is created and maintained, is the getting of work past the tool point. However numerous and complex the subsidiary activities, they all of them serve or should serve to this end and no other. It need hardly be pointed out that the functioning and maintenance of the tool is also implied in this definition, since if the tool were not at work we could not get the work past it in any useful sense.

From this definition as a starting point we may develop our first general proposition, viz., *That every legitimate expense in a machine shop is incurred for the purpose of getting the work up to, under or away from the tool point, in one way or another.*

One class of this expenditure is easily understood and mastered. The cost of the machine-operator's labor—and his labor is *at* the tool point—is in most cases a perfectly straightforward problem, and is handled successfully by existing cost methods. All the remainder, amounting to anything from 100 to 200 per cent. of direct operative labor is usually jumbled together into a common fund termed expense burden.

Now, while we persist in regarding this great mass of expense simply in the light of a lot of figures to be tabulated, analyzed, twisted or tortured in various ways, we may succeed in finding out a number of curious facts worthy of being put on exhibition in a museum, but we shall never get anywhere near knowing the very thing we ought to know—what is the operation cost per hour of each of our machines? We may figure our consumption of coal in terms of pounds weight of product, or ascertain the amount of lubricating oil used and its relation to each hundred dollars of wages paid, to a few decimal points—and I have known things done in an elaborately useless way almost as absurd as this —or we may do what is quite common practice and figure our expense burden as so much per cent. of our directly productive wages. I hope presently to have you agree with me that this latter proceeding is quite as meaningless as the other imaginery instances of the uses of "analysis" as applied to expense-burden figures.

Analyze Actual Activities

Suppose, however, that instead of applying our analysis to expense-burden *figures* we begin to analyze the actual activities which these figures represent —suppose, beginning with the principle that every item of expense has been incurred for the purpose of getting the work past the tool point, we go behind the *figures* and consider the *things*—asking ourselves, item by item, how this or that expenditure is related to the getting of work past the tool point.

The first, and in many ways the most important, discovery that results from such an analysis of manufacturing activities is that every manufacturer does a good many things beside manufacture. Some of these he does from necessity, others he does from choice, or because he sees a distinct economic advantage in doing them for himself. Stated in more abstract language—*actual production is the last organization in a chain of related but separate organizations.*

This is such an important point to grasp that I will restate it in another form. In order to manufacture economically, most manufacturers (and we may say all large manufacturers without exception), take on a number of nonmanufacturing functions, some of which are preliminary to production, such as that of landowner, landlord, or power supplier, and some of which are concurrent with, but subsidiary to, production, as, for example, storekeeping and costkeeping. The first three of these are entirely separable, and as a matter of practice are not always exercised by the manufacturer; the last two are, of necessity, always exer-

*Paper presented before convention of National Machine Tool Builders Association, slightly condensed.

†Industrial engineer, Boston, Mass.

cised by him without recourse to outside aid.

The Cost of Capacity to Produce

Now everyone who has given any consideration to the question of expense burden is aware that one of its most prominent characteristics is that it does not rise and fall proportionally with the volume of work in the shops. You pay for labor as and when you require it, but you have to foot the bills for expense burden whether you require it or not. If, therefore, you treat burden as an item of cost, you introduce a fluctuating element which very soon ceases to have any valuable significance when work is not steady in the shops. This is largely because the analysis of facts, the division of the functions of the organized factory into manufacturing and nonmanufacturing functions has been overlooked, and consequently the true meaning of expense burden has been missed. I will try to express what I believe to be its true meaning in a single phrase:

Expense burden represents, not the cost of production, but the cost of *capacity to produce.*

I will now carry the definition one stage further by saying that expense burden represents, in the main, the aggregate cost of the capacity to produce arising out of the nonmanufacturing functions exercised by the manufacturer, and that the true solution of the problem lies in our ceasing to think of expense burden as a whole, but in turning our attention to the various nonmanufacturing services and observing their relation to capacity to produce and then to actual production.

I would say that really, there is no such thing as expense burden—that there are only a number of separate expenses incurred to maintain various departments of the capacity to produce. The aggregation of expense-burden figures in a lump sum is, in fact, an inversion of the natural process. The cost of the different nonmanufacturing services rendered to production should never have been mingled at all.

Taking a Simple Case

In order to make clear to you exactly what is meant by nonmanufacturing functions, I will repeat a favorite illustration, which elsewhere, I have termed the "parable of the little shops." In a large plant these functions and their ramifications are in fact not easy to identify without considerable study, but in the progress from the most primitive form of industry up to the modern scale of manufacturing efficiency it can easily be seen how, one after another, these functions are assumed and incorporated with the direct manufacturing function.

An elementary form of manufacturing industry is more common in some European countries than in this. A man may work by himself on some specialized product which he sells either to some larger manufacturer or direct to a merchant. He will probably rent a room in a large factory building which is given up to such uses. His plant may consist of a single foot-power stamping press, and when this is the case we have manufacturing industry reduced to its simplest elements. The expense burden of such a worker consists of practically but two elements: rent of his shop and depreciation on his machine. Even here it is possible to imagine that expense is a serious matter to him. He pays a certain rent for his capacity to produce and for each kind of work there is a limit beyond which the work cannot afford to pay a higher rent. A stage further is the use of power. In these buildings power can be rented at so much per horsepower. and the question of the price of his power is a serious one to these "little masters" as they are termed. Even at this stage it is easy to recognize that two elements have entered into the cost of the worker's capacity to produce, quite irrespective of his actual production.

Let us assume now that he becomes ambitious. He thinks he could do better for himself by ceasing to buy his power, and he puts down a gas engine in a corner of his shop and makes his own power. By so doing he passes beyond the stage of a simple producer, and assumes nonmanufacturing function No. 1, viz., that of a supplier of power.

When he has installed his gas engine the problem takes on a more modern and familiar aspect. It has become relatively complex—if we like to make it so. What, we may inquire, is the proper method of arranging his cost accounts? The familiar way would be to analyze his indirect expenses—so much for rent, so much for gas, for lubricating oil, for ignition tubes, for repairs to the engine (which, we may imagine to be a second-hand one in poor condition, requiring frequent repair); to throw all the separate items into one "burden" or "establishment charge," and to allocate it as a percentage on wages cost by one or other of the well known and much debated methods. In other words, we confuse his function as producer with his function as supplier of power and, having mixed them up inextricably, we contentedly express the result of the jumble as a percentage on wages or time.

Keeping Functions Distinct

The alternative to this is obvious. It is to keep the two functions he has assumed perfectly distinct. Instead of consolidating his indirect expenses, he would do much better to preserve the more primitive form of his costs, and continue to recognize three factors as before, viz.: Time, rent and power. In order to do this satisfactorily he need take no more trouble. All he requires is to keep all his expenditure on power (that is, all the cost entailed by his function as supplier of power) separate and distinct from his other expenditure, and to express it not as a percentage on time, but as a rate per horsepower consumed. He will then obtain his power factor exactly in the same form as he originally had it when he rented his power.

If three or four such "little masters" may be supposed to meet together to talk over their methods and compare notes as to their relative efficiencies, it is obvious that if each of them knows only two facts about his production—his labor cost and the percentage of his total expenses to his labor cost—they will not be able to compare results favorably. For even though one of them discovers that his percentage is higher than that of his friend, he will not know why. But if the three production factors so far introduced are kept entirely distinct, intelligent comparison becomes at once possible. The rent factor of one is perhaps higher than that of another. The power factor of a third may be greater than that of his fellows. The introduction of the gas engine, for example, when reduced to a power factor, may easily be seen to be a mistake, whereas if treated in the ordinary way and made part of an expense burden, that unpleasant truth would have had a strong tendency to conceal itself.

Again, our supposititious worker may rent a piece of ground and erect upon it an iron workshop for himself. This introduces a further complication and is another step toward the complexity of modern manufacturing concerns.

From this illustration of the gradual adoption of nonmanufacturing functions, in the evolution from primitive forms to the large scale of modern industry, a general idea of the method of dealing with expense burden that I am advocating will easily be understood. Its characteristic lies in *keeping separate* the cost of the various non-productive functions exercised by the manufacturer and in ascertaining the rents payable by the direct manufacturing department for the services thus rendered.

I wish to outline how, in practice, this principle is made effective. The essence of it consists in carefully disentangling all the different items of nonmanufacturing services, and in observing how each of them, taken separately, bears on capacity to produce, first by departments, and then by individual machines. About the simplest case is that of a rented building, the rent of which is obviously easily reducible to an annual rent per square foot of available shop space, and this is charged up to the machine according to the space the latter occupies. Now where the land and the buildings are owned by the manufacturer, all the expense and outgoings on the property

(*Continued on page* 999)

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American Machinist

Special Modifications of Standard Machine Tools

Often a special-purpose machine is needed which appears to best met by a slight modification of a standard tool. Builders of machinery dislike these special orders and in figuring them usually add to the price of the entire machine as regularly built enough to cover the cost of all the new parts. For example a lathe may be required with a modified headstock, in which case the builder charges the price of the lathe plus the cost of a new headstock, regardless of the fact that he may either set the old headstock away complete in his stock room or may use parts of it in the new construction.

As a general thing a shop which is manufacturing, as distinguished from building one thing at a time, has no business to do jobbing or build special machinery as it is a losing proposition. Their routine is fixed, their men are largely operatives and incapable of doing general machine work advantageously. A special job must either be done in the tool room, by high-priced men or it clogs the wheels of shop routine. The cost of modified machines built in this way appears excessive to the customer even when the manufacturer is losing money in building them.

Would it not be better to buy such parts of a standard machine as are needed and turn them over to some builder of special machinery to be added to and erected? In this way each part of the work would be in the hands of men fitted to do it, both shops could make a legitimate profit and yet the purchaser be money in pocket. In a word the efficiency would be higher.

Selling to the Railroad Shop

While we realize fully that there have been vast improvements in the equipment and management of railroad shops, there is still room for improvement in several ways. One in particular, which affects the economy indirectly but none the less surely, is the difficulty in many cases of doing business with them nearly as satisfactorily as with manufacturing shops.

Railroad shops are notoriously hard for the average manufacturer to sell to on account of the devious path between the solicitation of an order and the requisition which must precede the sale. The methods of purchase are very indirect and consequently more expensive than they should be.

This not only makes it hard for the manufacturers of the machines, but also reacts on the railroads because more than one builder of good machinery has become discouraged or disgusted, or both, and bends all his efforts in other directions. In fact, some even go so far as to intimate that the railroad trade can visit warmer climates for all of them, as it is not worth the effort, to them at least.

This is a loss to the builder and often at least an equal loss to the railroad shop, and the sooner the buying for railroad shop can be conducted on the same business basis as the manufacturing shop, the better it will be for all concerned.

Needless Confusion in Terms

We recently heard a heart-to-heart talk by one of the best known electrical engineers in the country in which he deplored the use of meaningless or arbitrary terms in his own and other lines. He contended that much needless mystery was thrown around the industry by the use of coined terms instead of using words which are self-explanatory.

This unfortunately holds true in other lines as well, aëronautics being a glaring example at the present time. Such a term as "volplane" has no excuse for existence, as it simply means running without power, which in this case must mean coming down. In every other field this is designated as "coasting," this being applied to locomotives, automobiles and bicycles, as well as sleds and the festive roller coaster of the summer resort. Or even "gliding" would be understandable without a tutor and would always indicate flight without power.

There is no doubt as to the intentional confusion of terms in both law and medicine in order to mystify the layman, and there remains a tendency in this direction among some of the college professors who are more impressed with the dignity of their titles than with a real desire to spread knowledge. But the less of this we have in mechanics the better, and the more we can simplify terms and meanings the more we are reducing delays and the cost of doing business.

A Surprising Objection

The daily press states that the Bureau of Engraving and Printing, at Washington, is considering the substitution of power-driven presses for hand presses in printing bank notes. It is estimated that $1,000,000 a year can thus be saved.

Opposition has arisen because some

persons will be thrown out of work if the labor-saving machinery is introduced.

It is difficult for us to imagine how anyone can seriously urge such a reason for not using power-driven machinery, or quote it as an argument against the contemplated change. But for labor-saving machinery most of us would be back on the farms today amid the drudgery of severe muscular labor, and lacking the most common physical comforts that we now enjoy.

Yet the significance of this simple fact is so little appreciated that here in the United States in the year 1911, we hear an objection to the use of labor-saving machinery.

College Work in Industrial Engineering

The increasing attention which is being given to shop economics, intensive production, or efficiency management, as it may be variously called, is being reflected in the work offered at schools of engineering.

The latest piece of information of this kind to come to us is from the Pennsylvania State College, which has introduced a new course of study called the course in industrial engineering. The new course contains all of the fundamental studies in mathematics, mechanics and power-plant engineering common to the other engineering courses, the following additions having been made.

1. More actual shop practice; 2, class work in foundry and machine shops and general manufacturing processes and tools; 3, corporation accounting; 4, factory accounting, cost-keeping, routing, tracing, scheduling and similar systems; 5, factory economics, factory organization and administration; 6, a drafting-room course in the planning of equipment of a manufacturing plant; 7, logic to encourage systematic thinking, reasoning and tabulating of the data, composing new fields of knowledge; 8, psychology for the better understanding of human nature in the contact with working men, in purchasing and selling.

The new course already has twenty-three students, two having graduated last year.

New Publications

THE STRENGTH OF OXYACETYLENE WELDS IN STEEL. By Herbert L. Whittemore. 65 6x9-inch pages, with 25 illustrations. Gratis. The University of Illinois, Urbana, Ill.

We have had frequent occasion in the past to refer to the extremely useful and practical investigations undertaken at the engineering experiment station of the University of Illinois. The present pamphlet, which is bulletin No. 45 of the engineering experimental station, records a thorough series of experiments for the determination of the strength of welds made in steel by the oxyacetylene blowpipe. It is of immediate interest and value to all who have occasion to make use of this system of welding.

ELEMENTS OF MACHINE WORK. By Robert H. Smith. 180 pages 5x8 inches; 204 illustrations. Published by the Educational Publishing Company, Boston, Mass. Price, $2.

This is the first of a series of books of instruction in machine work, by the instructor of the laboratory of the Massachusetts Institute of Technology. It includes reading drawings; laying out work; chipping and filing; grinding wheels; drawfiling and scraping; hardening and tempering; case hardening; pipe fittings; soldering, brazing and babbitting; lacing belts, etc. The book is illustrated with very clear line drawings, which show just how the different tools are used and the way work is done, and while it is not supposed to make a skilled mechanic out of a boy or man who never saw a shop, it can hardly fail to assist many to obtain a clearer understanding of many things. There are also many mechanics whose opportunities have been confined to one line of work, who can secure much valuable information from this book.

THE STEEL WORKERS, by John A. Fitch. 365 pages 6x9 inches. Published by the Charities Publication Committee, 105 East Twenty-second street, New York. Price $1.50 net, postage, 21 cents extra.

Another of the Sage Foundation books, which gives a graphic and well illustrated story of the way in which steel is made as well as the conditions of the men and the way in which they work.

The author deals with the men as individuals, gives interviews with both satisfied men and with those who feel that they have a grievance, endeavoring at all times to give both sides a fair hearing. The causes, the conduct and the result of the Great Homestead strike are gone into in considerable detail, showing the reductions in wages, the earnings of company, the congressional investigation, and other details, among them a most interesting quotation from an article by Andrew Carnegie on strikes, in the "Forum" for 1886.

There is also a refutation of the statement so often made, that Homestead workers received fabulous wages, even well known books on metallurgy contending that some of the men were receiving $30,000 a year. From Frick's own testimony before the investigating committee, the highest paid roller could not have earned over $3280, assuming that the maximum output was maintained all through the year. And the lowest paid man received but $1.40 a day.

But the chapter on Speeding Up and the Bonus System is one of the most interesting in view of the present agitation for efficiency. It is stated that the output of sheet mills has doubled in 20 years without a single important change in machinery or methods. Surely no modern efficiency engineer would expect to exceed that. But the physical decline of men at 35 is a heavy price to pay for the increased output. There are other illuminating chapters.

Personals

Harry B. Eaton, for the past 10 years eastern manager for Hermann Boker & Co., with headquarters at Boston, Mass., has resigned.

Gordon C. Keith, managing editor of *Canadian Machinery,* has resigned in order to join the editorial staff of the *Canadian Manufacturer,* Toronto, Canada.

Cornelius T. Myers, who was formerly secretary and treasurer of the Wisconsin Engine Company, has become mechanical engineer of the General Motors Company, Detroit, Mich.

J. J. Chisholm, until recently engineer with the New York Edison Company, has accepted the position of superintendent of power of the Tennessee Coal, Iron and Railroad Company, Ensley, Ala.

Charles W. Cade has recently resigned as foundry manager of the Blake & Knowles Steam Pump Works, of E. Cambridge, Mass., which position he has held for the last eight years. Mr. Cade is at present engaged in consulting work.

J. A. Bailey, chief engineer of the Electric Boat Company, Quincy, Mass., has in addition become secretary and treasurer of the New London Ship and Engine Company, Groton, Conn., to which the offices of the Electric Boat Company have been moved.

D. T. Randall, a member of the mechanical engineering staff of Arthur D. Little, Inc., Boston, Mass., has been appointed resident engineer of the engineering laboratory of the General Motors Company, Detroit, Mich., of which the Little corporation are directors.

A. W. Hopkins, purchasing agent and office manager of the National-Acme Manufacturing Company, Cleveland, Ohio, has been appointed sales manager of the product department. E C. Woolgar, formerly Western sales manager, has been made sales manager of the machinery department, and R. J. Preston succeeds Mr. Woolgar in the West.

William Hill, chief of the small-tool department of Alfred Herbert, Ltd., Coventry, England, is at present in this country for a 10 weeks' stay. Mr. Hill's mission is for the purpose of acquiring agencies for American special machine and small tools for representation in Great Britain, France, Italy, Belgium, Japan and India, and during his present stay will make his headquarters at the AMERICAN MACHINIST office.

Shop Equipment News

ANY and all new or improved machines, tools or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here — the machine shop news.
A more full and detailed description will be given — when it is real news — if it can appear here first — before it is sent to other papers. ALL descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German

Horizontal Cylinder Boring Machine

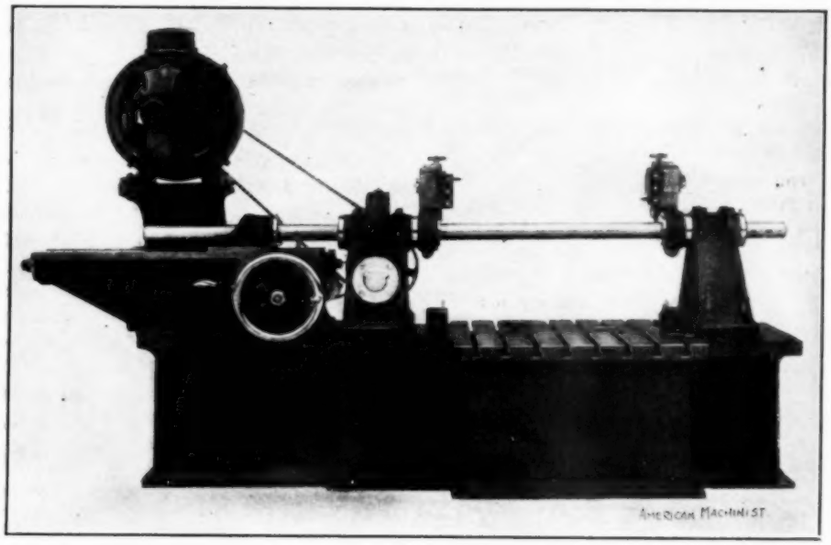
This machine was designed for boring and facing simultaneously, steam, gas, pump and water cylinders, as well as for boring guides and facing ends of engine frames.

The machine has a continuous feed travel to the boring bar in either direction of 30 inches, that is, it will bore out and face off both ends of a cylinder of this length with one setting of the boring bar.

The boring bar is furnished either 2½ inches or 3 inches in diameter, and is made of hammered steel of 0.60 point carbon, fitted with Morse taper hole in end with draw and drift slots, so that smaller bars can be used when necessary.

Pedestals are 18 inches from top of bed to center of the boring bar, and the tail pedestal is adjustable along top of bed from zero to 30 inches. Power is transmitted by the Hindley type worm and worm wheel.

The machine is equipped with a quick-change feed box mechanism, having six different feeds as follows: 1/32, 1/16, 3/32, ⅛, ¼ and ⅜ inch per revolution of the boring bar. It is equipped with two heavy substantial facing arms which are mounted on the end of sleeves, which are driven by friction and may be started and stopped at will.



HORIZONTAL CYLINDER-BORING MACHINE

The machine is regularly furnished with a four-step cone pulley for 3-inch belt, with corresponding cone on countershaft. Countershaft has two friction pulleys 12 inches by 4 inches for double speed, giving eight speeds to the boring bar.

The halftone shows the machine driven by a 5-horsepower, 4 to 1 variable-speed motor, which is mounted upon a bracket bolted to the side of extended frame, the connection being made from motor to driving shaft by endless belt.

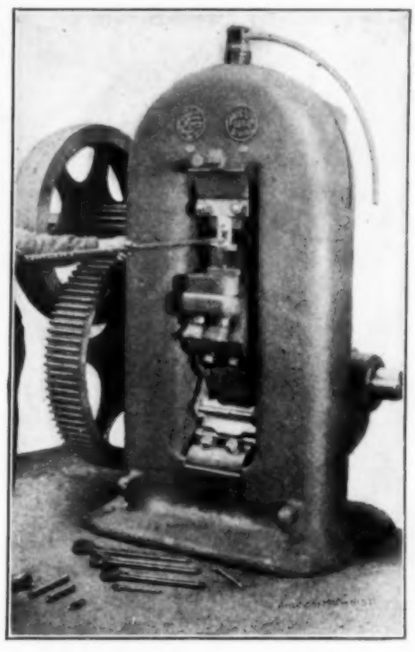
The machine is built by the Barrett Machine Tool Company, Meadville, Penn.

Press for Staybolt Blanks

The halftone shows a special press built by the Ferracute Machine Company, Bridgeton, N. J., fitted with dies for forming square heads on staybolt blanks.

The frame is very massive, being a single solid casting with only 14 inches between the housings.

The press has a stroke of 2 inches, the ram being forced upward when the steel toggles are straightened out by the six-inch steel shaft at back of press. The fly-wheel weighs 1100 pounds, is 40 inches diameter and runs at a speed of 180 revolutions. The machine weighs over 16,000 pounds and gives a pressure of 400 tons. The head, to which the upper die is attached, may be adjusted downward as much as ½ inch by means of a wedge adjustment operated by bolt and lock-nut. The bolt at the top of the press keeps the head firmly up against the frame, the spring at that point having sufficient tension to take the weight of the head when operating the wedge adjustment. The forming dies are V shaped and the gage at back of press is adjustable so that bolt blanks of various lengths may be cut off.



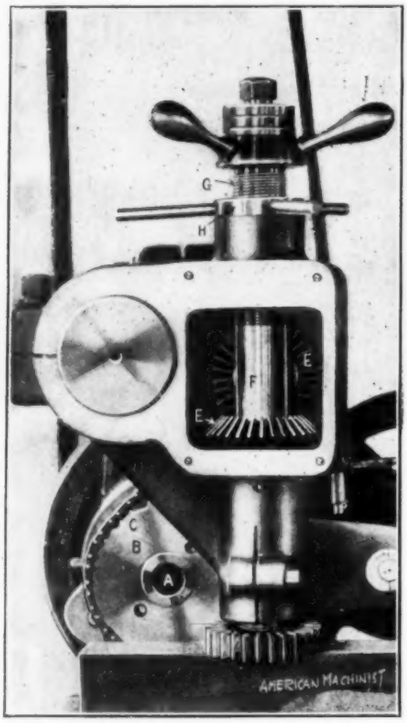
FERRACUTE STAYBOLT PRESS

Formerly bolt blanks were headed at the rate of about one per minute, the blanks having been previously cut off from the bar. The machine shown performs the two operations in one at the rate of 30 per minute.

A Vertical Milling Attachment

The halftone shows the front view of a new milling attachment, which has just been brought out by the G. R. Lang Company, Meadville, Penn. The body of the device is held on the overhanging arm as shown.

A is the hole in the spindle. *B* is a sprocket screwed on the end of the spindle. The chain *C* drives the spindle *F* of the vertical attachment through the sprocket *D* and the miter gears *E*. *G* is the adjusting screw which is operated by the pilot *I* and is locked in position by the nut *H*. The spindle runs in a cast-iron bearing. Cutters can be



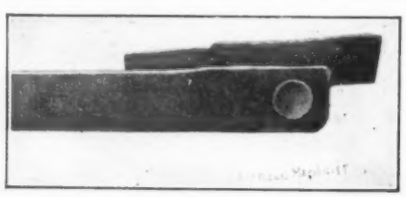
FRONT VIEW OF ATTACHMENT

mounted in both the milling-machine spindle and in the spindle of the attachment.

The attachement is very rigid and will carry a heavy cut. The cut being taken in the illustration is ¼ inch deep and 2 inches wide, with a feed of 3 inches per minute in cast iron.

Lang Tool Holder

In this tool holder the cutter is set at an angle in the holder so that the cutting point projects outside of the holder proper. This allows a cut to be taken up into the corner and to face down a high shoulder without the necessity of swiveling the holder in relation to the work.



LANG TOOL HOLDER

Two Spindle Adjustable Port Boring Machine

The machine shown was designed and constructed for the purpose of boring the four valve ports in the cylinders of Corliss engines, two holes being bored simultaneously, then the cylinder reversed and the remaining two ports bored. Holes from 3 inches to 9 inches in diameter and up to 6 feet long may be bored, at any distance from 8¾ inches to 37 inches between centers of the holes.

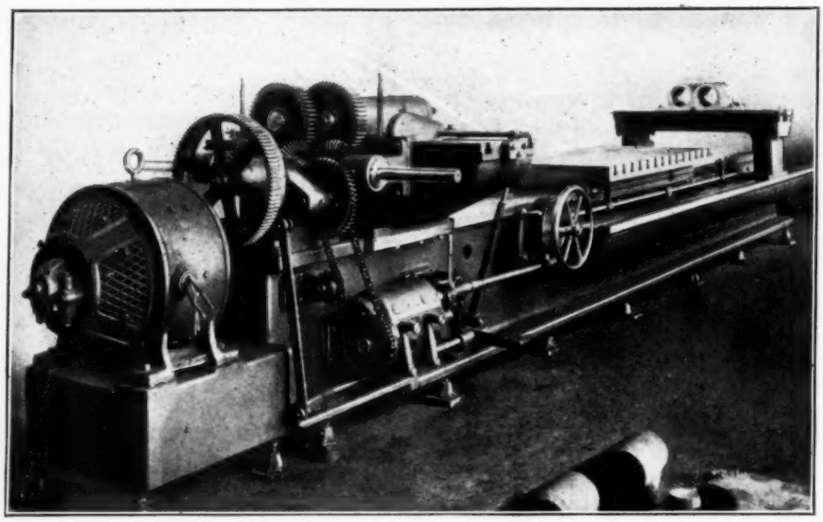
To obtain accuracy in boring such long holes, the boring bars holding the tools are revolved in one position, and the work is fed in either direction past the cutting points, thus eliminating any inaccuracy due to the springing of the boring bars.

The feed mechanism may be reversed by the small lever at the right of the feed box, so that the roughing cut may be fed in one direction, new tools inserted, and the finishing cut made as the table feeds back. The table has a quick-power traverse in either direction, which is run independently of the spindle drive by a small motor on the back of the bed. This allows the table to be run back quickly while the bars are not revolving, thus preventing scoring of the finished bore by the tools. The quick traverse is controlled by the long lever below the spindle saddle, which operates friction clutches.

The table has a work surface 36 inches wide and 6 feet long, with a travel of 13 feet 4 inches. A hand wheel is provided for fine adjustments.

The spindles are driven by a 10-horsepower motor, geared direct through a reduction from motor to spindles of 36 to 1. They run in taper bronze boxes with take-up to compensate for wear.

The adjustment of the driving mechanism for different center distances is provided for by transmitting the power from the large drive gear to a shaft at a right angle to the spindles. Each spindle head has a bracket attached to it, and carries a bevel gear which slides on this shaft and in turn transmits the power from the shaft to the spindle gears. This method permits locating the spindles without altering the driving mechanism.



TWO-SPINDLE ADJUSTABLE PORT BORING MACHINE

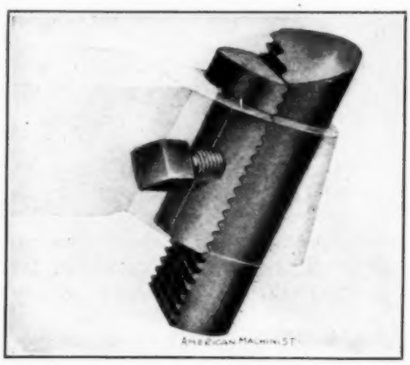
The machine weighs, without motors, approximately 24,000 pounds, and is a recent product of the Beaman & Smith Company, Providence, R. I.

Round Nose Roughing Tool

This new tool has been especially designed for heavy duty service at high speed.

In the design of this tool, and the tool holder, the Taylor angles have been adopted. The cutter is made of a high quality high-speed tool steel and given a heat treatment such as to secure the required uniform red hardness.

This style of tool is made in four sizes by the Ready Tool Company, Bridgeport, Conn.



ROUND-NOSE ROUGHING TOOL

Variable Blow Power Hammer

The accompanying photograph illustrates a new variable-blow power hammer recently put on the market by the Welch Hammer and Machine Company, Cleveland, Ohio.

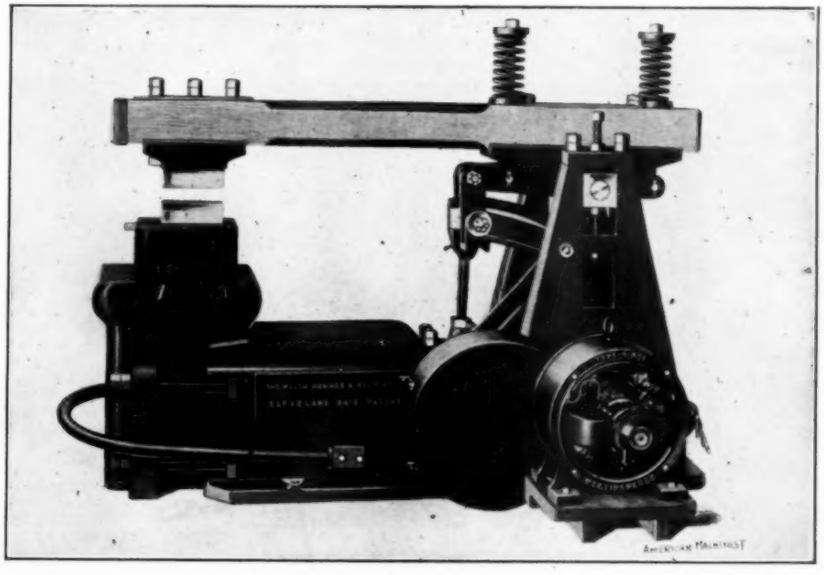
The motion of the eccentric to the helve is transmitted through the link mechanism by means of which the throw of the helve and the blow is varied at the will of the operator.

A swinging bracket which supports and pivots one end of the link segment, is balanced on bronze bushings which also form the main bearings of the driving shaft. This bracket is connected by means of two short links to the treadle. A hardened bearing block, accurately fitted to the slot in link segment has its end bearings in the U links, pendant from the beam lever. The short ends of U-links are connected by means of straight links to points in the housings directly in line with the pivot point of link segment at full stroke. The machine runs at a constant speed of about 300 revolutions per minute.

The illustration shows the machine with direct-connected motor and with the link segment shifted to position of full stroke. The flywheel for belt drive and the motor and gearing for motor drive can be applied to either side of the machine and the motor drive can be applied to all sizes and styles of these machines. A balancing mechanism is located between the housings and balances the swinging bracket and removes all weight of the helve from the links. The helve is balanced on pivot shaft and beam lever by means of the coil springs on top of helve. These springs are adjustable and keep the helve under tension, with the result that the helve vibrates like a spring and strikes a sharp blow.

The anvil weighs 1500 pounds or 25 times the weight of the hammer head. The complete machine weighs about 5000 pounds. All the links and other small parts subject to strain or shock are steel castings or forgings. The helve is made of seasoned hickory.

The machine is also made for belt drive in which type the machine operates with tight belt.



VARIABLE-BLOW POWER HAMMER

Automatic Fluting Machine

This machine is designed for fluting taps or reamers four at one time, and is built in two sizes, the one shown being for work up to ½ inch diameter, while the larger size, which is back geared, will handle work to 1½ inches diameter and is also furnished with fixtures for squaring the shanks of taps.

AUTOMATIC FLUTING MACHINE

The action of the machine is entirely automatic after the work is placed between the centers, the carriage making the forward and return movements and the centers indexing at the proper time for the different flutes.

The carriage returns at a speed five times as great as it advances, and is arranged to stop its travel if by any chance the indexing should be improperly done, as well as at the completion of the work.

The method of returning the carriage makes use of a gear box, in which are three sets of compound gears by means of which together with a sliding clutch it is possible to reverse the direction of the ordinary telescope shaft and worm feed. The ratio of the gears for the return is 5 to 1 and a special device is used which throws the sliding clutch from the forward to the reverse gear with no knocking or chance to pause during the change of direction.

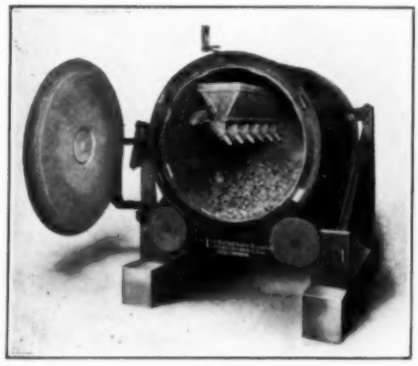
The indexing of the centers is accomplished by means of a short spiral gear cut in each spindle, and these in mesh with a spirally fluted cross shaft which carries at one end an index collar with the necessary stops, etc., for determining its motions, and to which power is applied by means of a second collar mounted on the same shaft and connected by ratchet teeth to the index collar. The cutters are supplied with oil from a tank in the base of the machine.

The machine is manufactured by the Bickford Machine Company, Greenfield, Mass.

Sand Blast Rolling Barrel

The accompanying halftone shows a self-contained sand-blast rolling barrel recently developed by the New Haven Sand Blast Company, New Haven, Conn.

The barrel automatically replaces sand in the hopper, and the sand and steel shot is used over and over again until ground very fine, when it is carried off in the exhaust. The construction is such as to allow four to six nozzles, as will be seen, which makes for efficiency and rapidity.



SAND-BLAST ROLLING BARREL

As is shown the barrel revolves about the stationary head, ejecting sand from each nozzle under air pressure ranging from 40 to 80 pounds.

The complete barrel weighs nearly 4000 pounds, having a solid cast-iron frame to support the barrel and equipped with lock-nuts throughout. The roller bearings are outside of the barrel and protected, and the barrel makes but three revolutions per minute.

Swaging Machine with a Pneumatically Operated Holder

The accompanying illustrations show a swaging machine arranged with a holder in which the feed of the work into the dies and the opening and closing of chuck are operated by compressed air.

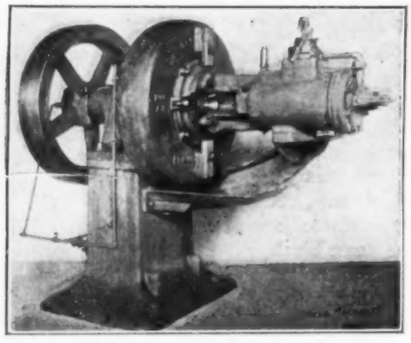


FIG. 1. SWAGING MACHINE WITH PNEUMATICALLY OPERATED HOLDER

Fig. 1 shows the holder in position ready for use, while in Fig. 2 the holder is shown swung to one side in order to permit the removal and entering of dies and the inspection of swaging parts of machine.

The holder consists of a cylinder hinged to the cover of the swaging machine and supported at its outer end by

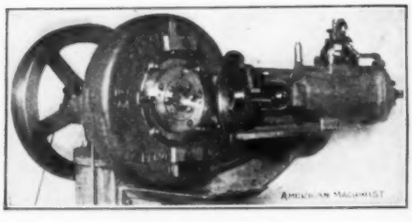


FIG. 2. HOLDER SWUNG TO ONE SIDE

a rail on which it rides when swung to the side. The main or cylinder piston actuates the feeding of the work into the dies and also its withdrawal. An auxiliary piston operates the opening and closing of the chuck. The two pistons operate independently of each other. The style of chuck used is of the spring type. Both pistons are controlled by a specially designed triple-action valve shown on the top of the cylinder in the illustrations. The construction of the oscillating part of this valve is such that it compensates for its wear and maintains a uniform pressure on its seat. A hand and thumb lever is used for operating the valve. The hand lever controls the feeding of the work into the dies and also its withdrawal, and the thumb lever controls only the closing of the chuck.

The releasing of the chuck is automatically done by the movement of the piston on the extreme end of its outer stroke by coming in contact with a piston valve provided for this purpose. By means of the trip lever on end of cylinder head, the chuck can be released at any part of the stroke. The inlet and outlet air connections are located in the rear of the valve.

The machine equipped with the pneumatic holder is a recent product of the Langelier Manufacturing Company, Providence, R. I.

Taper Hobbing Attachment for an Automatic Gear Hobber

The Schuchardt & Schütte Company has on the market a taper hobbing attachment for its regular automatic gear hobber, which was designed to do away with some of the troubles incident to the use of a straight hob and to also make possible the use of a fly cutter for certain classes of work.

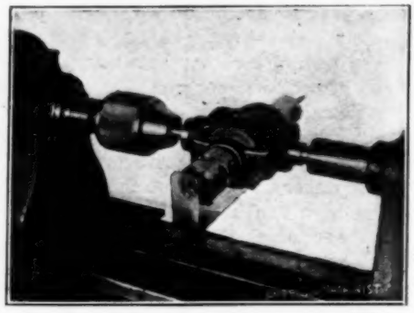
It is well known that hobbing a worm wheel with a straight hob is only satisfactory when the angle of the hob thread is slight, as in single-thread hobs of large diameters, and that as the number of threads and angle increase, it makes a very rough and unsatisfactory job, leaving high ridges on the teeth, which causes the worm to bear only in spots; but by using the attachment and a taper hob, such as shown in Fig. 1, a perfectly smooth and true tooth is obtained, and for cutting multiple threads of high leads this attachment is indispensable.

Fig. 2 shows a fly cutter being used in place of the more expensive hob, the photograph of which was obtained in the shop of the A. B. See Electric Elevator Company, Jersey City, N. J.

The attachment is bolted to the machine in place of the regular head and a special geared mechanism is used to run the chain operating the bevel gears and cross-slide screw, in order that the taper hob or fly cutter may be fed across at the proper rate.

Tapping and Threading Attachment

This tool is readily applied to a lathe and is shown in position for outside threading. For tapping the attachment is reversed or turned over, thus bringing tap holder to front of the lathe; this



TAPPING AND THREADING ATTACHMENT

being done in the same manner as removing lathe centers.

An adjustable gage is furnished with each attachment, which is convenient for some work though not absolutely necessary, as the operator may at will withdraw the piece being tapped or threaded.

The attachment is made by the J. C. Barrett Company, Hartford, Conn.

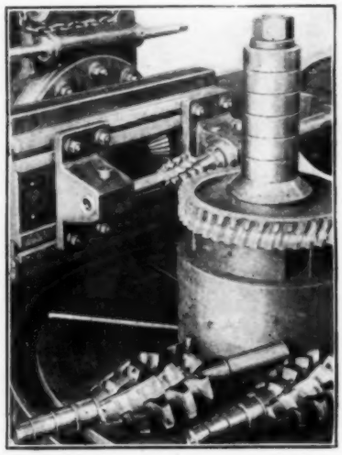


FIG. 1. TAPER-HOBBING ATTACHMENT AND HOBS

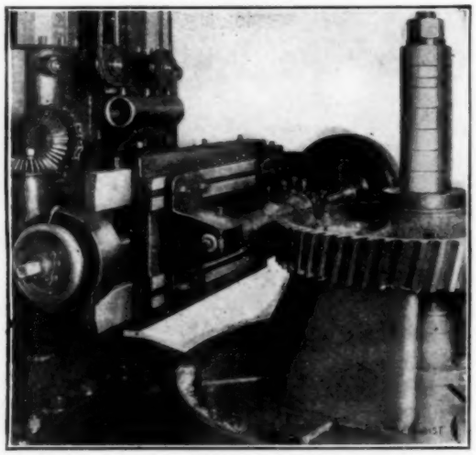


FIG. 2. TAPER ATTACHMENT USING FLY CUTTER

Distribution of the Expense Burden

(*Continued from page* 992)

are kept by themselves, and commuted into a rent exactly as if the property were rented from an outsider. They are not thrown into a general collection of similar charges and called expense burden. The exact bearing of that particular nonmanufacturing function called property-owning on capacity to produce is ascertained just as it would be ascertained if the property were rented from an outsider. All the group of expenses belonging to it are segregated and merged in an annual rent. Further, it has been found to be quite as easy to segregate all the other indirect or nonmanufacturing services and reduce them to rents chargeable for such services, instead of throwing them into a general expense-burden fund.

Charging Indirect Services

When all such indirect services have been segregated and reduced to rents, these are charged first against departments, and then against individual machines on various bases of allocation. The total charge standing against each machine is then divided by the number of working hours in a month or year and so an hourly rent for the use of that machine is determined.

I should like you to understand that this determination, though it may be unfamiliar to you, is a purely logical process. That is to say that there is nothing arbitrary in it, but logical reason can be shown for the presence of each item of expense just where it is placed, so that there is no possible appeal from the final result. The final machine rents are actual or natural rents payable for the capacity to produce.

When all such rents for indirect services have been determined, and given an outlet on to jobs in the form of machine rents, a further and most important principle of my method comes into play. The capacity to produce may not always be utilized to the full. In the case of a given machine having a rent of 25 cents per hour, whatever work is done at it is charged at 25 cents an hour whether the shop be full or slack. That is to say that on this method, alone among expense-burden methods production cost is unaffected by conditions in the shop. You must not punish the job because part of your capacity to produce is being wasted. You have only used 25 cents worth of the capacity to produce which that particular machine possesses, and that is all the job should be charged with.

What Becomes of Idle Time?

This idle time represents *wasted* capacity to produce, first of the machines individually, secondly of the machines collectively in departments, and thirdly of the plant as a whole. In practice the total of idle time by departments is the significant figure. The total of this idle time is ascertained and expressed as a supplementary rate or percentage on the monthly total of machine rents already charged to jobs. You may think that here we get back to a percentage after all. So we do. But consider what this percentage is. It is the ratio of wasted to utilized resources. Something quite new and very important to know.

This supplementary rate may or may not be charged to individual jobs, as preferred. Personally I do not think that there is any great use in doing so, as long as the ratio is determined and made known month by month. For it represents waste and nothing else, and has no real connection with particular jobs at all. If you do charge it up, then you have total costs made up of direct labor, cost of indirect or nonmanufacturing services as expressed in machine rents and a third figure which gives you a more or less arbitrary allotment of the waste. But I prefer to consider such waste as a separate job, and a very bad job, and keep it as a separate item in the shop accounts. For the sake of "rounding off" the costs it is sometimes distributed, but I regard this as a concession to the old idea of getting rid of figures by distributing them somewhere and somehow, regardless of whether the result has any true significance or not. In my idea waste is waste and when you have separated it out, face it squarely and admit that it is none the less waste if you arbitrarily spread it over jobs. I allow that this is sometimes an uncomfortable thing to have to do.

The Principal Elements

To sum up, I will briefly enumerate the principal elements of this method of ascertaining true costs of production, separated from wasted capacity to produce.

First, instead of throwing all indirect expenses together into a common fund of burden, and then elaborately analyzing them in the despairing effort to make something significant out of them, we segregate and keep separate the cost of all nonmanufacturing services.

Secondly, having segregated each group of expenses we determine the rent charge that must be made for it, precisely as the owner of a terrace of houses settles what rent he will charge individual tenants. But, of course, in the case of these service rents, there is no item of net profit included.

Thirdly, each department is charged up with its due share of each of these service rents.

Fourthly, the share of individual machines in each of these different service rents is ascertained.

Finally, at the end of this process, each machine will have been found to be charged with a number of annual rent charges, which represent the annual cost of that machine's capacity to produce. These separate charges are aggregated and commuted into an hourly machine rent, which is charged against all work done at that machine.

This completes the cycle of true costs. The residue which is left over because idle machines have not charged the whole of their "capacity to produce" onto jobs is collected together monthly, and represents waste pure and simple,

Machine Builders Convention

The spring meeting of the National Machine Tool Builders Association was held in Atlantic City on May 18 and 19 with a good attendance.

The various committee reports dealing with Patents, Cancelation of Orders, Merchant Marine and Definition of Machine Tools were well received.

Both President Geier and Secretary Hildreth spoke in favor of a broader view of the industry, of getting away from sectional lines and from the idea that actual money getting was the sole object.

A paper on the "Distribution of Expense Burden" was presented by A. Hamilton Church, an industrial engineer of wide experience abroad but now of Boston, which appears elsewhere.

Friday's sessions were devoted to the problems of shop organization on the basis of equipment and also on the basis of product—the first being advocated by F. C. Kent, superintendent of the Pierce-Great Arrow Company, of Buffalo, N. Y., and the second by C. W. Auel, of the Westinghouse Electric and Manufacturing Company, of Pittsburg, Penn. Both of these papers will appear later.

F. W. Taylor gave a very interesting talk on the subject of scientific management, which was listened to with marked attention, but which was not discussed for lack of time.

In the afternoon, the question of employers' liability and workers' compensation was presented by F. C. Schwedtman and James A. Emery, who have done such commendable service in the compilation of the volume recently published by the National Association of Manufacturers. The meeting was one of the most successful ever held from all points of view.

The following firms were elected to membership in the association: Brown & Sharpe Manufacturing Company; Standard Manufacturing Company; Cincinnati Gear Cutting Machine Company; Miami Valley Machine Tool Company; Stoever Foundry and Manufacturing Company; U. S. Electrical Tool Company; Burke Machinery Company; Higley Machine Company; Masillon Foundry and Machine Company; Steinle Turret Machine Company; Cochrane-Bly Company; Meisselbach-Catucci Manufacturing Company.

Increasing Shop Capacities

METAL WORKING

NEW ENGLAND

M. Blassburg will build an addition to his scrap-iron plant at Turners Falls, Mass.

W. H. Baker, of Milford, Mass., will build a new garage on Spruce street, Milford, Mass.

The Connecticut Clasp Company, Bridgeport, Conn., has taken out a permit for a new factory.

The Southington (Conn.) Manufacturing Company will build an addition to its hardware factory.

The Terry Steam Turbine Company, Hartford, Conn., is about to enlarge its plant to double its capacity.

An $18,000 building for the Pope Garage, Pawtucket, R. I., will soon be erected on East avenue that city.

The Whiting Manufacturing Company, Bridgeport, Conn., will build an addition to its silverware factory on Bishop avenue.

Brown & Dowd Manufacturing Company, of Meriden, Conn., is having a new factory built. The concern manufacturers hardware.

The Standard Manufacturing Company, Bridgeport, Conn., manufacturing automatic gear cutters, slotters, electrical specialties, etc., is said to be contemplating the erection of an additional factory building.

MIDDLE STATES

The Everhart DeLaney Company, of Oshkosh, Wis., will erect a foundry.

The Ohio Valley Brass and Iron Company will erect a foundry at Deandale, Ohio.

E. H. Fitch is having a garage built at Boulter and Fox streets, Philadelphia, Penn.

Fire did $25,000 damage to the plant of the Franke Steel Range Company, Cleveland, Ohio.

The Reynolds Wire Company, of Dixon, Ill., will build a $75,000 wire factory at Gouverneur, N. Y.

The Lima Locomotive and Machine Company, Lima, Ohio, will increase the capacity of its plant.

The Oriental Metal Bed Company, Hoboken, N. J., will erect a new factory at Clinton and Eighth streets.

W. H. Smedley is having an addition built to his garage at Orthodox and Adams avenues, Philadelphia, Penn.

Dayton Bed Springs Company, Dayton, Ohio, has been incorporated by W. H. Pritz to manufacture bed springs.

Henry Goldner Boiler and Tank Works is building an addition at Water and Mifflin streets, Philadelphia, Penn.

The City Auto Garage, Youngstown, Ohio, has been incorporated for $20,000 to conduct a garage by John W. Kuhns.

The Ward Fence Company, Decatur, Ind., is arranging for the erection of an addition to its main factory building.

The Northwestern Malleable Iron Company, Milwaukee, Wis., will build a $42,000 addition to its plant on Park street.

Wm. J. Hess, of Manitowoc, Wis., will shortly erect a machine shop, foundry and boiler works, at Green Bay, Wis.

A permit has been issued to Grant Curry to build a garage on Murray Hill avenue, Fourteenth ward, Pittsburg, Penn.

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

The Mahony Boiler and Radiator Company, Troy, N. Y., has purchased new and larger quarters and will enlarge its plant.

The Bell & Dauber Company, of Oshkosh, Wis., will erect a plant for the manufacture of wood-working machinery at once.

Miami Cycle and Manufacturing Company, Middletown, Ohio, has increased its capital, and will make additions to its plant.

The Westman Motor Truck Company is negotiating with the Chamber of Commerce, Painsville, O., for a site for a plant.

The Continental Motor Manufacturing Company, of Muskegon, Mich., will establish a plant in Detroit to employ 1000 men.

The shovel department of the Indiana Rolling Mill Company, at Newcastle, Ind., destroyed by fire recently, will be rebuilt.

The Broderick Boiler Company, Muncie, Ind., is constructing new building and will install new machinery. Will double capacity.

Fire caused a loss of about $30,000 to the machine shop of Theodore Smith & Son, Hudson and Essex streets, Jersey City, N. J.

Norwalk (Ohio) Motor Car Company will put up a new factory in the fall. Will want latest machinery. Fred Taylor, superintendent.

Estimates are being made on plans for a round house to be erected at Bulson street, Camden, N. J., for the Atlantic City Railroad Company.

The South Bend (Ind.) Chandelier Company has been organized by A. Listenberger, A. S. Tenscher, L. P. Tenscher to make chandeliers.

The Benedict Manufacturing Company, Syracuse, N. Y., is planning a large addition to its factory for the output of a portable electric light.

The Biggs Boiler Company will erect a $50,000 addition to its plant in East Akron, O. This will include boiler shop, machine shop and power plant.

The Homer Brass Works, Incorporated, is rebuilding its brass works factory at Water and Mifflin streets, Philadelphia, to replace the one destroyed by fire.

Plans for the new $90,000 repair shop for the Milwaukee (Wis.) Electric Railway and Light Company at Fortieth street and Cold Spring avenue have been filed.

The plant of the Herron-Webb Engineering Company, Monongahela, Penn., was destroyed by fire. Loss, $75,000. The company manufactured mine fans, pumps, etc.

Oscar Gustafson and Staples have opened a shop at 243 West Sixty-ninth street, New York, for automobile repairing. Would like catalogs of automobile parts, etc.

The Sheboygan Railway and Electric Company, Sheboygan, Wis., will build new shops at Clara avenue and South Eighth street. W. O. Weeks, architect, Sheboygan.

The Stutz Auto Parts Company, Indianapolis, Ind., manufacturer of automobile parts, will build a large factory building at once, in Tenth street, near Senate avenue.

After being closed for three years the Linton (Ind.) Rolling Mill Company's plant will resume work within the next sixty days, just as soon as repairs are completed.

The Thomas B. Jeffery Company, manufacturer of motor cars, at Kenosha, Wis., will add two large additions to its plant. A drop-forge shop is in course of construction.

The Goulds Manufacturing Company, Seneca Falls, N. Y., pump builders, will erect three new buildings at plant No. 2 to which plant No. 1 will move when completed.

The Wm. F. Meyers Saw Company, Bedford, Ind., has been incorporated by W. F. Meyers, V. A. T. and G. V. Albright, to manufacture saws for stone-cutting purposes.

The Ralston Steel Car Company, Columbus, Ohio, is asking prices on machinery, including motor-driven plate shear, axle lathes, car-wheel borers, wheel press punching machines.

The Delco Manufacturing Company, Dayton, Ohio, has been organized to manufacture electrical appliances of all kinds by Benj. F. McCann, H. H. McGrew, Howard B. Cromer, etc.

The Elmer Auto Company, Elkhart, Ind., has been incorporated with $700,000 capital to manufacture automobiles. Incorporators, H. H. Elmer, H. H. Murden, J. P. O'Shaughnessy.

The Glenwood Garage Company, Newark, N. J., has been incorporated with $125,000 capital to conduct an automobile garage by Herbert L. Greene, W. F. Greene, Casper F. Greene.

The Massillon Wire Box Company, Massillon, Ohio, has been incorporated to manufacture wire boxes by John E. Johns, Clarence W. Schwurn, Martin B. Schultz, etc. Capital, $25,000.

The Newton Motors Company, Newark, N. J., has been organized to manufacture motors, engines, machinery, etc. Capital, $10,000. Incorporators, A. F. Egner, W. E. Brown, Jr., Conover English.

The Chase Motor Truck Company, Syracuse, N. Y., is now erecting a new building to be used for garage and repair department, which will allow more space for manufacturing in its old building.

The Automatic Light and Power Company, Chicago, Ill., has been incorporated to manufacture electric appliances and machinery. Capital, $250,000. Incorporators, H. Jones, O. M. Wermich, M. W. Zabel.

The American Shop Equipment Company, McCormick building, Chicago, Ill., has been formed to manufacture a complete line of fuel-oil furnaces and appliances for annealing, case-hardening, melting, etc.

The White Motor Car Company, Newark, N. J., has been incorporated to manufacture automobiles, motor cycles, etc. Capital, $50,000. Incorporators, Edmund G. Langhorne, Orange; R. D. Reynolds, Newark, etc.

The Lafayette Electric and Manufacturing Company, Lafayette, Ind., has been incorporated with $200,000 capital to manufacture electrical appliances. Incorporators, A. E. Schelthe, W. M. Baker, B. P. Shearer.

The Parkhurst Die Casting Company, Anderson, Ind., has been incorporated with $100,000 capital by W. T. Durbin, W. N. Durbin and L. M. Parkhurst. Will erect a plant for the manufacture of die-casting machines.

The Binn-Downs Manufacturing Company, Canton, Ohio, has been incorporated with $10,000 capital to manufacture metal and wooden novelties of all kinds by James R. Binns, Elmer E. Downs, Anna M. Downs, etc.

The Engineers Appliance Company, Cleveland, Ohio, has been organized with $20,000 capital to manufacture and sell all kinds of appliances for steam and hydraulic construction, by J. F. Doolittle, A. P. Fothergill, R. J. Venning, etc.

A permit has been issued to the Standard Dental Manufacturing Company, manufacturers of dental instruments, for a two-story factory building at Twenty-fifth street, south of Diamond street, Philadelphia, Penn., to cost $20,000.

The Twyman Motor Car Company, Columbus, Ohio, has been incorporated to manufacture and sell motor cars and do a general repair and garage business. Capital, $30,000. Incorporators, B. W. Twyman, Eugene Morgan, Henry O'Kane, etc.

The Vincennes Tractor Company, Vincennes, Ind., has been incorporated to manufacture gasolene traction engines. Capital, $50,000. Incorporators, J. N. Dyer, F. L. Oliphant, Edward Watson, etc. Will locate in Star Shovel and Range plant.

The Johnson-Morse Can Company, Wheeling, W. Va., capitalized at $1,000,000, has absorbed the Wheeling Can Company and the La Crosse (Wis.) Can Company. New building will be erected at Wheeling and the La Crosse plant removed to that place.

The Pittsburg Crucible Steel Company which recently acquired the Midland plant at Midland, Penn., of the Midland Steel Company, will increase the capacity. It is said several new open-hearth furnaces will be constructed and several plants and mills for working up raw materials into finished products. Steel argicultural implements will be manufactured.

SOUTHERN STATES

The Kansas City (Mo.) Structural Steel Company is forming a subsidiary company to locate a plant in Houston, Tex.

The Anglo-American Mill Company, Freeman Little, president, Owensboro, Ky., is in the market for machine-shop equipment.

WEST OF THE MISSISSIPPI

S. Larson's blacksmith shop at Richville, Minn., was burned.

Hansen Brothers, of Walnut, Ia., will erect a garage and blacksmith shop.

Nels P. Brown, of Atlantic, Ia., will erect a two-story, 50x100, blacksmith shop.

James H. Carter will erect a blacksmith shop for Hill Anthony at Glenwood, Iowa.

The Crawford Garage Company, at Faribault, Minn., wil erect a two-story garage.

The Baker Machine Company, San Diego, Cal., has purchased a site for a new machine shop.

Mr. Schneckloth, of Marion, Iowa, will erect a plant at Nevada, Iowa, for the manufacture of farm implements.

J. F. McCarthy will erect a two-story garage at 1300-4 Hennepin avenue, Minneapolis, Minn., to cost $34,000.

Hallock Cole, Melrose avenue, Los Angeles, Cal., has taken out a permit to build an addition to his blacksmith shop.

The Southern Pacific Railroad has taken out a permit at Portland, Ore., to build a new repair shop at its Eighteenth street yards.

The National Ice and Cold Storage Company, Los Angeles, Cal., has taken out a permit to build a blacksmith-shop addition to its plant.

O. L. Hartley and R. B. Connor, Escondido, Cal., will establish a new commercial garage and repair shop. Modern equipment will be installed.

The Oregon-Washington Railroad and Navigation Company, Portland, Ore., will build a new freight-car repair shop at its Albina yards.

The Pacific Electric, Los Angeles, Cal., will remove its car barns at Long Beach to another site. The capacity of the new barns will be enlarged.

The Los Angeles-Pacific Railroad (electric), Los Angeles, Cal., is planning to move its car barns in Santa Monica and will increase the capacity.

The Waterman-Waterbury Company, farm implements, Minneapolis, Minn., has secured a site on University avenue and will erect a new $100,000 plant.

The Lacy Manufacturing Company, Los Angeles, Cal., machinery and specialties, has taken out a permit to build an addition to its plant, to be used as a machine shop.

The Empire State Manufacturing Company, Spokane, Wash., capitalized at $200,000, will establish a plant at 118 Second avenue, for the manufacture of a hardwood floor scraper.

The Northern Pacific will expend $1,000,000 in 1912 in improvements to its shops and roundhouse at Spokane, Wash. The present plant will be moved to Yardley, near Spokane.

The California State Normal College is to be augmented by a large addition to be used for manual-training work. Plans are being prepared by State Architect W. D. Coates, Sacramento.

The Board of Education, Porterville, Cal., will issue bonds for $100,000 to be used in the construction of shop buiirings for manual training. A full equipment of machinery will be installed in connection.

The Board of Trustees, Orange (Cal.) High School district, is having plans prepared for a manual-training and domestic science school. A machine shop, foundry and forge department will be included. Modern machinery will be installed.

The United States Steel Corporation has acquired the Risdon Iron Works plant, San Francisco, Cal., manufacturers of mining and special machinery. Adjoining property has also been purchased and extensions to the present plant and capacity will be made.

R. S. Bulla, Perris, Cal., is at the head of a company which has purchased a site and will build a factory for the manufacture of galvanized-iron ware. The plant will be equipped with modern machinery. The Southwestern Sugar Company, Perris, is also said to be interested.

The Western Steel Corporation, Seattle, Wash., will be reorganized with new directors. Funds will be raised to increase the capacity of the steel and machinery plant at Irondale, Wash., to build a new coke plant in the vicinity of Seattle, and to build a new steel-works plant, on a site already purchased, at New Westminster, B. C.

The United States Steel Corporation is negotiating for the purchase of the Moran Shipbuilding Company's plant at Seattle, Wash. In event of purchase, the new owners will install a large addition, to be equipped with machinery for steel fabrication and for handling structural shapes. The Corporation has also purchased a site at Portland, Ore., and will build a plant for the handling of its finished products.

CANADA

The Canadian Fairbanks Company will equip a branch factory in Winnipeg.

Cockshutts Plow Works will make further extensions to its plant at Brantford, Ont.

The Gordon Nail Company will locate a $100,000 factory at Medicine Hat, Alberta.

The Gilette Safety Razor Company is building a large addition to its Montreal factory.

The London Concrete Machinery Company, of London, Can., will build a big new factory.

The Buffalo Brake Beam Company will build a large new factory at St. Catherines, Ont.

Big extensions will be made to the C. P. R. Angus repair and locomotive shops at Montreal.

Fire at the plant of the Allis-Chalmers-Bullock, Limited, Rockfield, did about $75,000 damage.

The Canadian Steel Foundries Company, of Welland, Ont., is making big extensions to its plant.

The Canadian Pacific Railway will build large new machine and repair shops at Coquitlam, B. C.

The Canadian Pacific Railway has secured a permit to build a roundhouse at London, Ont., to cost $60,000.

The British Columbia Steel Company will establish a street-railway plant at Port Mann, C. N. R. Pacific terminus.

American Car and Foundry Company will build at once a plant to commence with 2000 men at Port Mann, C. N. R. terminal.

The A. B. Jardine Company, Hespeler, Ont., will erect a new molding shop. The company manufactures blacksmiths' and boilermakers' tools.

The Waterous Engine Works Company, of Brantford, Ont., has commenced the erection of a large plant to double its present capacity.

GENERAL MANUFACTURING

NEW ENGLAND

Ossipee, N. H., will extend its water system.

The town of Lancaster, N. H., will install boilers.

North Haven, Me., proposes installing a new water system.

Braintee, Mass., will make improvements in its water system.

Stoughton, Mass., will make improvements in its sewer system.

The Houlton (Me.) Woolen Mills Company will erect an addition.

Norwich, Conn., will build a new reservoir. Pumps will be needed.

The Portland (Me.) Gas Light Company will build an addition.

Shelburne Falls, Mass., will spend $75,000 improving its water system.

The Fitchburg (Mass.) Enamel Company will build an addition to its factory.

Leonard & Barrows, of Belfast, Me., contemplate addition to their shoe factory.

The Brightwood Paper Mill at Hinsdale, N. H., was destroyed by fire. Loss, $50,000.

The Boston Duck Company, of Bondville, Mass., will build a new addition to its mill.

The United Drug Company, of Boston, Mass., will add a new building to its plant.

Carl Stohn Company, silk manufacturers, will build a new factory at Hyde Park, Mass.

Pepperell Cotton Mill Company contemplates building a new mill at Biddeford, Me.

The Prince Rupert Meat Company, Vancouver, B. C., will build a new cold-storage plant.

International Rubber Company, West Barrington, R. I., will install a 200-horsepower engine.

The Kroger Piano Company, Stamford, Conn., is figuring plans for addition to factory.

J. H. S. Jones, Bridgeport, Conn., will erect an addition to his show-case factory on William street.

The town of Hyde Park, Mass., will extend its water system and will build a pumping station.

The American Paper Goods Company, Kensington, Conn., has placed contract for addition to factoy.

Edward Demars, of Southbridge, Mass., will build a new bakery. Modern machinery will be installed.

The Rollins Engine Company, Nashua, N. H., is considering the installation of a new power plant.

The New Hampshire State Sanatorium, at Warren, N. H., will build an addition to its boiler house.

The North Attleboro, Mass., Electric Light Company is in the market for a 300-horsepower engine.

W. H. Collins & Co., bookbinders and printers, of New Bedford, Mass., will build a new addition to its factory.

J. S. Bennett, proprietor of the Union Laundry, New Britain, Conn., is figuring on plans for a new building.

The Stoughton Rubber Company has awarded contract for construction of a new factory at Stoughton, Mass.

The Dawson Power and Light Company, Dawson City, B. C., will increase the capacity of its power plant on Coal creek.

The plant of the Empire Laundry Company, 17 Beacon street, Worcester, Mass., was destroyed by fire with a loss of $12,000.

The Fairfield County Dairy Company has awarded contract for construction of dairy plant at South Norwalk, Conn.

The S. A. Woods Machine Company, South Boston, Mass., is figuring plans for a new power house. It will install a boiler and a pump.

Alfred L. Lustig, who was formerly superintendent of the Glenlyon Dye Works, Phillipsdale, R. I., is going into the same kind of business for himself.

MIDDLE STATES

The Racine (Wis.) Basket Company will erect an addition.

The K-W Ignition Company, Cleveland, O., will erect a new plant.

The C. D. Clark Lumber Company, of Merrill, Wis., will erect an addition.

Fire destroyed the elevator of O. Gandy & Co., at Lucerne, Ind. Loss, $20,000.

The Manning & Peckham Paper Company, Troy, N. Y., will erect a two-story mill.

The Dayton (Ohio) Lighting Company has taken out a permit for a one-story addition.

The Mechanicsville (N. Y.) cold-storage plant was destroyed by fire. Loss, $20,000.

The big potash factory of A. Mendleson, Albany, N. Y., which was burned, is to be rebuilt.

Rockville Center, L. I., N. Y., will vote on the appropriation of $17,000 for a new power house.

The village of Bloomingdale, N. Y., will install a waterworks system at a cost of $15,000.

A. S. Tomison, Jr., is having a garage built at 510 East Mt. Pleasant avenue, Philadelphia, Penn.

The Wausau (Wis.) Street Railway Company will spend $50,000 in improvements to its plant, etc.

The Arpin Lumber Company of Radisson, Wis., is considering the erection of a $1,000,000 pulp mill.

The Hummel & Downing Company, Milwaukee, Wis., will erect a new $175,000 paper-box factory.

The Wood Products Company, Buffalo, N. Y., will erect a two-story addition to its plant on Fourth street.

The flour mill of the Pendleton Milling Company, Pendleton, Ind., was destroyed by fire. Loss, about $12,000.

Fire destroyed three boiler houses, fifteen derricks and oil tanks of the Parsons Oil Company, at Eldred, Penn.

Mexico, N. Y., is having plans prepared by W. G. Stone, Mann building, Utica, N. Y., for waterworks to cost $50,000.

The hosiery mill of Ernest J. Ancott, of 4945 to 4947 Wakefield street, Philadelphia, Penn., was destroyed by fire.

Grocers and Butchers Ice Company, Columbus, Ohio, has increased its capital to $125,000. Will improve ice plant.

The American Agricultural Chemical Company will build a $5000 power house at 114 Fleming street, Buffalo, N. Y.

The underwear factory of the Galland Brothers, of Wilkes-Barre, Penn., was destroyed by fire. Loss, $25,000.

Mount Vernon, N. Y., will spend about $5000 on artesian wells and a pumping station to increase its water supply.

The American Maize Oil Refining Company will build a factory at Bloyd and Winter streets, Indianapolis, Ind., at once.

Yonkers, N. Y., will spend several thousand dollars on an auxiliary water supply by means of wells. J. A. Brady, commissioner.

The Minn Billiard Company, Milwaukee, Wis., will erect a new factory at 1520 to 1530 Buffum street, to replace the one burned.

A seven-story addition will be made to the packing plant of Burk Brothers, at Bodine and Wildey streets, Philadelphia, Penn.

Damage amounting to several thousand dollars was done by fire in the shoddy mill of the Peerless Fibre Company, Cohoes, N. Y.

Fire destroyed the factory of the Adler Veneer Seat Company, 59-73 Milton street, Greenpoint, Long Island, N. Y. Loss, $30,000.

Fire destroyed the electroplating and lighting-fixture plant of J. L. Gaumer, of Twenty-Second and Wood streets, Philadelphia, Penn.

Bids have been received for the construction of a four-story factory for the Cocoran Lamp Company, of Cincinnati, Ohio, to cost $25,000.

The Stanyon Furniture Company, Buffalo, N. Y., has been incorporated by H. & C. E. Stanyon, E. A. Meisreimer, etc. Capital, $100,000.

The largest cheese factory in Steuben county (N. Y.), that of the Newark (N. J.) Milk and Cream Company, at Rexville, N. Y., was burned.

At Massillon, Ohio, the Stark-Tuscarawas Brewing Company will spend $40,000 this summer in rebuilding the wash and malting departments.

Gordon Brothers, Philadelphia, Penn., manufacturers of curled hair, have let the contract to rebuild their factory recently destroyed by fire.

The city council, of Decatur, Ind., is making arrangements to greatly increase the capacity of the city water-pumping station. New wells will be drilled.

The Ontario Button Company, of Amsterdam, N. Y., will move to Utica, N. Y., where it will occupy a building three times as large as its present plant.

The Philadelphia Electric Company has purchased a site at the corner of Sixth street and Germantown avenue, Philadelphia, Penn., for a new power plant.

The Thatcher Sugar of Milk Baking Powder Company, of Potsdam, N. Y., is considering a larger plant for manufacturing paper milk bottles and milk-bottle fillers.

The Hubbard Chemical Company, Indianapolis, Ind., has been organized to manufacture chemicals by C. E. Wood, M. W. Welsh, M. McMillan. Capital, $10,000.

The Huntingburg Furniture Company, Huntingburg, Ind., has been incorporated with a capital of $25,000 by E. B. Fish, G. D. Brown and H. A. Gabriel, to manufacture furniture.

The Kibler Chemical Company, Indianapolis, Ind., has been incorporated with a capital of $50,000 by E. R. Kibler, E. V. H. Shockney and J. W. Bowlus, to manufacture paint.

The Indianapolis (Ind.) Paper Novelty Company has been incorporated with a capital of $50,000 by W. A. Scott, Michael Hess and M. W. Hopkins, to manufacture paper goods.

Schwanbeck Brothers, Detroit, Mich., manufacturers of show cases, shipping cases, etc., have secured site for a new plant to cost $200,000. Separate power house will be erected.

The Mogie Shoe Repair Jack Company, Mishawaka, Ind., has been incorporated with a capital of $10,000 by J. A. and S. E. Mogie and R. S. Fieg, to do a manufacturing business.

The Cleveland (Ohio) Painesville & Eastern Railroad Company will increase the capacity of its Painesville power station and will build substations at Willoughby and Nottingham.

The Allen Jarvis Paper Box Company, Camden, N. J., has been organized to manufacture paper boxes, etc. Capital, $25,000. Incorporators, Allen Jarvis, R. A. Force, E. R. Saunders.

T. U. Delophena & Co., of Jersey City, N. J., will move to Poughkeepsie, N. Y., where a new plant will be erected. The concern manufactures chocolate, also cans citron, etc.

Sealed proposals will be received at quartermaster's office, Twenty-Sixth street and Gray's Ferry road, Philadelphia, Penn., until June 9, 11 a.m., for one 200-horsepower water-tube boiler.

The Eagle Woodenware Manufacturing Company, Hamilton, Ohio, has been incorporated with $50,000 capital. Incorporators, Frank M. Fritsch, Chas. Diesbach, Edward Fritsch and James Kelley.

President H. S. Grimes, of the Portsmouth (Ohio) board of trade, has received word from Philadelphia to the effect that the American Drying Company will remove from that city to Portsmouth.

Two buildings and their contents of the John Grover & Son, manufacturers of curled hair, wool and shoddy, were destroyed by fire at Somerset and Tulip streets, Philadelphia, Penn. Loss, $100,000.

SOUTHERN STATES

Fire destroyed the lumber plant of G. S. Baxter & Co., at Fargo, Ga. Loss, $100,000.

The lumber plant of G. S. Baxter & Co., Fargo, Ga., was burned. Loss, $100,000. Will be rebuilt.

The sawmill plant of the Flowers Lumber Company, at Jakin, Ga., was destroyed by fire. Loss, $50,000.

WEST OF THE MISSISSIPPI

Mr. Darting, of Glenwood, Ia., will erect a canning factory.

Robert Brown, Trout Lake, Wash., will build a new sawmill.

Berglund Brothers, of Cloquet, Minn., will erect a bottling works.

Ehr Brothers, of Minot, N. D., will erect a modern mattress factory.

The Indio (Cal.) Ice and Cold Storage plant was destroyed by fire.

The sawmill of Tiedy Brothers, near Melrose, Idaho, was destroyed by fire.

The Cornell Creamery Association will erect a creamery at Henriette, Minn.

H. D. Schaaf, of Spring Brook, N. D., will erect a building for feed-grinding mill.

Alden Brothers, of Laconite, Minn., are considering the erection of a creamery.

The Shasta Lumber Company, Marysville, Cal., is building an addition to its plant.

The city of Centralia, Wash., will install a new sewer system in its south district.

H. M. Wood, Oroville, Wash., is planning for the erection of a fruit-canning plant.

The Acorn Brick and Tile Company, of Glenwood, Minn., will erect a plant shortly.

The Turgeon-Conrad Shingle Company, Seattle, Wash., will build a dry-kiln addition to its plant.

The Brandel Chemical Company, Seattle, Wash., has taken out a permit to build a new factory.

The Star Brewery Company, Portland, Ore., will make improvements and additions in its plant.

The city of Tucumcari, N. M., is planning to install a waterworks system. Bids will soon be asked.

The Dispatch Laundry Company, Minneapolis, Minn., will erect an addition at 2612 Stevens avenue.

The Murphy Water, Ice and Light Company, Needles, Cal., is contemplating improvements to its plant.

Thode & Grindl, San Bernardino, Cal., have taken out a permit to build a new bottling-works plant.

The plant of the Kaiser Box Company, South Stillwater, Minn., was destroyed by fire. Loss, $200,000.

The city of Orland, Cal., has voted bonds for $50,000 for the installation of a waterworks and sewer system.

The Nez Perce & Idaho Railway, Nez Perce, Idaho, is planning to increase the capacity of its power plant near Greer.

The power plant of Kendall Brothers, of Pittsburg, Penn., at Roseburg, Ore., was destroyed by fire. Loss, $50,000.

The Orange County Dried Fruit Association, Santa Ana, Cal., is having plans prepared for a new packing house.

J. M. Shea, of Wichita, Kan., is considering the erection of a cold-storage plant to cost $16,000, at Fort Dodge, Ia.

The Sanitary Laundry Company, Sixteenth street, San Diego, Cal., has taken out a permit to build an addition to its plant.

The St. Elmo Cigar Company, Los Angeles, Cal., is having plans prepared for a new factory. B. S. Jarrett is head of this company.

The Hollister Townsite Company, Hollister, Idaho, will install a telephone exchange and system in this section. A franchise has been granted.

The city of Dixon, Cal., has voted bonds for $40,000 for the installation of a sewer system and a septic system for sewage disposal.

A site will be furnished at Bend, Wash., to erect a $250,000 woolen mill for the Union Woolen Mills Company, of Washougal and Union.

Power-plant equipment will be required in the new theater to be erected at San Francisco, Cal., by Alex. Pantages. Estimated cost, $400,000.

R. A. Collins and V. P. Gilbert, Los Angeles, Cal., have taken out a permit to build an addition to their dye works on Sixteenth street.

The Clifford Asbestos Shingle Mill, Boise, Idaho, will build a factory for the manufacture of its product. Mr. Clifford is head of this organization.

The Home Telephone Company, Los Angeles, Cal., will make improvements and double the capacity of its plant at Long Beach. Estimated cost, $100,000.

Power-plant equipment will be required in the new six-story office building to be erected by William Land, capitalist, Sacramento, Cal. Plans will be prepared at once.

The Cutting Packing Company, Stockton, Cal., is having plans prepared for a new fruit-packing plant to be erected at Acampo. Modern machinery will be installed.

Power-plant equipment will be required in the new theater and hotel building to be erected at Fresno, Cal., by George R. Andrews and others. About $225,000 will be expended.

The Siskiyou Light and Power Company, Yreka, Cal., has been granted a light and power franchise in Shasta county. The company is planning for operations in this section.

The city of Alameda, Cal., will vote bonds for $175,000 for municipal improvements. Of this amount $100,000 will be expended upon a new electric-lighting plant and machinery for generation.

The Sioux Falls Flour Mill Company, Sioux Falls, S. D., will purchase a 500-horsepower motor-drive equipment for its mill on specifications by E. F. Burch, engineer, Minneapolis, Minn.

The Idaho-Continental Mining Company, near Port Hill, Idaho, will install a new power plant in the near future. Fred Burbidge is manager of this company. E. J. Carter, of Spokane, Wash., is interested.

The Board of Supervisors, Los Angeles, Cal. (H. J. Lelande, county clerk), will receive bids until June 5 for ice-plant equipment, laundry machinery and engine-generator set to be installed at the Los Angeles County Farm.

A. Seabert, Redondo Beach, Cal., is at the head of an organization which will build an ice and cold-storage plant on Francisco avenue. About $15,000 will be the initial expenditure. A fish-smokery plant will also be established.

A. Davidson and J. E. Drendel, Los Angeles, Cal., will take over the Pabst Brewing Company's interests in this vicinity and operate under the Pacific Coast Beer Company. A new local plant will be erected and will be fully equipped.

The Rubin Electric Power and Lumber Company has been incorporated at Chelan, Wash., by Charles Rubin and William H. Schokel, with a capital stock of $500,000. The company is planning for extensive operations in this section. Mr. Rubin will act as manager.

Ex-Governor David R. Francis, St. Louis, Mo., is at the head of an organization which is planning to install power plants on the Pecos and Devils rivers in western Texas. A large irrigation system is also planned. About $5,000,000 will be expended. D. B. Chapin, Edinburg, Tex., is also interested.

CANADA

Cochrane, Ont., will install $50,000 worth of waterworks machinery.

Carlyle, Sask., will install a complete new waterworks pumping plant.

The W. C. Edwards Company will build a big planing mill in Ottawa.

Camrose, Alberta, will spend $85,000 for new waterworks machinery.

The Pittsburg Plate Glass Company will establish a plant at Port Mann.

The London Gas Power Company, of London, Can., will build additions to its plant.

L. A. Roy will install $50,000 worth of machinery in a cooling plant at Winona, Ont.

Fire destroyed the charcoal plant of the Standard Iron and Lumber Company, of Sault Ste. Marie, Ont.

The Firstbrook Box Company, Toronto, Ont., will erect a three-story factory at Ontario and King streets.

W. McArthur, of the Dominion Match Company, Deseronto, will equip a $70,000 branch plant at Port Arthur, Ont.

The big mills of the Western Canada Flour Company destroyed by fire at Gilbert Plains, Manitoba, will be rebuilt.

The big plant of the Parry Sound Box Company, destroyed by fire at Parry Sound, Ont., will be reequipped immediately.

A new power house will be built at Rouleau, Sask., and tenders are being called for large quantities of equipment and supplies.

The National Hydro Electric Company will equip a million-dollar power plant near Montreal. H. Miles, Montreal, president.

Engineer Somerville, of Hamilton, Ont., is interested in an electric railway that will be established to Galt and other cities.

Thirty-five thousand dollars worth of new machinery and equipment will be bought for the St. Thomas (Ont.) Street Railway.

The S. Lloyd Company will locate a large new factory in Owen Sound, Ont., for manufacturing children's gocarts and carriages.

Machinery destroyed by fire in the plant of the Canada Furniture Company's factory at Montreal will be replaced at once. Loss, $70,000.

It has been decided to build the immense new plant of the Canada Cement Company two miles south of Oak Point Junction, near Winnipeg.

Ham & Mott, mattress manufacturers, of Brantford, Ont., have decided to make still further additions to the extensive buildings now near completion.

MINING

The Miller Mining Company, Crescent, Nev., will install a new milling plant.

The Warren Peak Mines Company, Sundance, Wyo., will install a new milling plant.

The Valadoro mine, Sonora, Mex., will build a reduction plant in the near future.

The Cochise Gold Mining and Milling Company, Tucson, Ariz., will build a new milling plant.

Sivori Brothers, operating near Tuolumne, Cal., are planning to install a stamp mill in the near future.

The Eagle's Nest mines, operated by William Kirwin, Searchlight, Nev., will build a new milling plant.

The Arctic mine, near Washington, Cal., will build a 250-ton reduction plant during the coming summer.

The Esperanza mines, Oro Blanco district, Ariz., will install new concentrating and cyaniding machinery.

The Taylor mine, near Georgetown, Cal., will install a cyanide plant. Mr. Chester is interested in this work.

The Revenue mine, near Newhouse, Utah, is planning to install a new milling plant. About $100,000 will be expended.

The Nevada Eagle Mining Company, Nelson, Nev., will build a 20-stamp mill. A cyanide plant will also be erected.

Thomas Wilson, Manhattan, Nev., is planning to install a large hydraulic plant for placer work near Clifton, Ariz.

The Ora Rica Mining Company, near Coulterville, Cal., will install a 20-stamp mill. The capacity will be increased in the near future.

The Zona mine, near Searchlight, Nev., will install a reduction plant in the near future. A. S. Ganes is manager of this property.

The Los Alles Mining Company, operating the Las Delicias mine, Jalisco, Mex., is contemplating the building of a stamp mill in the near future.

The Vanadium Company, Cutter, N. M., will double the capacity of its 730-ton concentrating plant. W. A. Bonitz is manager of this company.

The Sunrise Gold Mining Company, Calente, Nev., is contemplating the installation of a 40-ton amalgamation plant. R. L. Mack is engineer in charge.

Business Item

The J. W. Paxson Company, Philadelphia, Penn., is just completing a new factory building, covering an area of 9000 square feet. It is of steel and concrete construction, and has a saw-tooth roof. It will be equipped with uptodate machinery for manufacturing a general line of foundry appliances and materials.

Forthcoming Meetings

International Master Boiler Makers' Association, Omaha, Neb., May 23, 24, 25, 26, 1911.

American Foundrymen's Association, annual convention, Pittsburg, Penn., May 23 to 26, 1911. Richard Moldenke, secretary, Watchung, N. J.

American Society of Mechanical Engineers, spring meeting, Pittsburg, Penn., May 30 to June 2, 1911. Secretary, C. W. Rice, 29 West 39th St., New York City.

Society of Automobile Engineers, midsummer meeting, Dayton, Ohio, June 15, 16 and 17, 1911. C. F. Clarkson, secretary, 1451 Broadway, New York city.

National Gas and Gasolene Engine Trades Association, summer meeting, Detroit, Mich., Hotel Ponchartrain, June 20-23, 1911.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. M. W. Rice, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Caliper catalog free. E.G.Smith, Columbia, Pa.

Self-setting planes. Vineland, N. J.

Special machinery developed and manufactured. Tompkins Bros. Co., Troy, N. Y.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

"Engineering Data" is gaining ground. It helps others, why not you Box 788, AM. MA.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Automatic and light machinery, tools, jigs, dies and fixtures designed. B. Nash, 257 Martense St., Brooklyn, N. Y.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Our machine shop solicits either patented article or small machine or tool to manufacture; royalty or cash. Box 853, AM. MACH.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Wanted—Machine and press work; tools, dies, jigs and machines built to order. The G. M. Diehl Machine Works, Wabash, Ind.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Light and medium weight machinery and small parts in quantities; also screw machine and punch press work, tools, jigs, dies and high grade machinery. The Elgin Tool Works, Elgin, Ill.

Wanted—A responsible firm to take American or Canadian manufacturing rights of Humphris gear, described in this issue. Information from E. M. Le Flufy, Box 874, AMERICAN MACHINIST.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

Patents—An able mechanical engineer will see and protect technical points better; valuable suggestions and assistance in developing inventions. G. M. Sacerdote, M. E., and Reg'd Patent Attorney, 1919 Broadway, New York City.

Mechanical engineer, inventor, 20 years' experience, wants party to produce marine and stationary crude oil engines; cheapest power, smokeless, carbonless; surpassing all present engines; patents secured. Box 890, AMERICAN MACHINIST.

A young growing factory in Indiana has reached the point where new capital or consolidation with strong manufacturer will produce exceptional profits in short time; have not been able to meet demand of the automobile trade; basic patents; will bear close investigation. Box 891, AMER. MACHINIST.

Welding by oxy-acetylene process; special attention given to repairs of machinery and castings of all kinds; large experience in difficult experimental work; structural shapes welded together; write for particulars. Krajewski-Pesant Co., 54 Beard St., Brooklyn, N. Y.

Manufacturer of telegraph machines, adding machines, taxameters, accurate interchangeable parts, dies and special tools, invites orders for similar special manufacturing. The Universal Telegraphic Company, Successors to the Rowland Telegraphic Company, Baltimore, Md.

A large and well known firm in central New England, which has been engaged in the manufacture of special machinery for upwards of forty years, is desirous of taking on some outside lines, its own legitimate line of manufacture being suffering from a depression in business, and in order to keep as many of its employees busy, and its organization as intact as possible during the dull period, we wish to make connections for taking on outside lines of machine work; our plant is a very complete and modern one; our machine tool equipment represents an investment of about $125,000; we have a full line of gear cutters, automatic screw machines, and Jones & Lamson turret lathes, etc.; our capital is ample, and we guarantee to handle in a satisfactory manner any work that may be intrusted to us. Write us your requirements. Address Box 72, Worcester, Mass.

Help Wanted

Classification indicates present address of advertiser, nothing else.

CANADA

Wanted—General foreman for machine shop, running about sixty men on pumping machinery; state experience and wages expected. Box 885, AMERICAN MACHINIST.

COLORADO

Wanted—Are you a good molder and foundryman? Are you a good machinist? Have you good brains and business wits? Are your habits and character good? Have you saved good money—cash? If so, I can give you a good opportunity in a good, established, profitable business; this I have and under its demands I wish to unite with me brains, ability, character and their evidence, some cash. Address "South-Western Colorado," AM. MA.

CONNECTICUT

Wanted—First class toolmaker. Address B. L. Co., Norwich, Conn.

Wanted—A good engineer and designer to take charge of drafting room of machine shop in Connecticut; man with experience in shop as well as in office preferred. Send application to "W," Care AMERICAN MACHINIST.

ILLINOIS

Wanted—High grade man as master mechanic and tool room foreman; must be absolutely first class, good executive and systematizer; telephone work; factory in Chicago. Box 873, AMERICAN MACHINIST.

KENTUCKY

Wanted—Man thoroughly familiar with gasolene motors and some motor boat experience, to run three large engines on houseboat cruising on western rivers; permanent situation; to live on the boat. Address, giving age, experience, references, etc., Box 847, AM. MA.

MASSACHUSETTS

Wanted—First class grinder on automobile parts, capable of handling three or four men; Landis and Brown & Sharpe machines. Box 866, AMERICAN MACHINIST.

Wanted—Inspector on automobile parts; factory near Boston; only first-class man considered; state experience and wages expected. Box 865, AMERICAN MACHINISTT.

Wanted—Experienced machine designer to work on light automatic machines; give age, experience and salary wanted. Address "Machine Designer," Care AMERICAN MACHINIST.

Wanted—Department foreman in Massachusetts city; a man to take full charge of 50 to 75 men, making tools for metal stamping and drawing; must be thoroughly familiar with modern methods and have ability to handle men to the best advantage and produce results; best of references required. Address, stating full particulars, Box 888, AM. MACH.

MICHIGAN

Wanted—High-grade detail draftsmen and tracers, experienced on automobile work; must be neat and accurate; state age, education and salary expected. Address John Springer, chief draftsman, Brush Runabout Company, Detroit, Mich.

Wanted—Superintendent for a roller bearing factory; must have exceptional mechanical ability; experienced in all branches; accustomed to very accurate work and capable

of handling help to best advantage; give age, experience in detail, salary expected and references; replies will be treated confidential and not used without permission. Box 857, AMERICAN MACHINIST.

MINNESOTA

Wanted—First class assistant superintendent for machine shop, quick thinking man with practical experience, who is familiar with modern shop practice, and who can secure the maximum production from modern high speed tools; splendid opportunity for the right man; give all possible details in first letter. Box 884, AMERICAN MACHINIST.

NEW HAMPSHIRE

Wanted—One master machinist (outside) at $6 per diem; a competitive examination will be held May 29, 1911, for the purpose of filling the above position. For further information address "Commandant," Navy Yard, Portsmouth, N. H.

Wanted—A superintendent for a plant of 150 to 200 men, making small interchangeable work; must be thoroughly uptodate in manufacturing methods, understand piece-work system, and the use of high speed steels; a good organizer and know how to handle men; a good position is open for the right man. Box 854, AMERICAN MACHINIST.

NEW JERSEY

Lathe hand for 96-inch Putnam lathe wanted for night shift, also boring mill hands on horizontal and vertical mills for day shift; good job for the right men. Apply Crocker-Wheeler Co., Ampere, N. J.

Water wheel chief engineer, thoroughly competent designer and constructor to take full charge of latest uptodate Francis turbine wheels and governors; applicant must have extended experience; give full particulars. Box 855, AMERICAN MACHINIST.

NEW YORK

Experienced man for milling department to take charge of from 75 to 100 men in machine shop doing general work; state age, experience, nationality and where formerly employed. Address "Cincinnati," Box 840, AM. M.

Wanted—Assistant foreman for iron machine shop; man experienced on valve work preferred; in replying state if now employed, experience, age, married or single and wages expected. Address reply, "B.P.," Box 65, Elmira, N. Y.

Wanted—Machinists wanted, lathe hands, screw machine hands, etc.; steady position, desirable surroundings, good wages, no labor trouble. Apply by letter, giving account of past experience. Maxwell-Briscoe Motor Co., Employment Bureau, Tarrytown, N. Y.

Wanted—A good all-around tool repairer; one who can repair iron working tools, both fixed and portable—lathes, planers, shapers, drills, taps, dies, reamers, etc.; the right kind of a capable man can connect with a permanent position at good pay; give full particulars when answering. Box 880, AM. MA.

Mechanical or electrical engineer wanted by a large machinery manufacturing concern doing an international business, to take the position of treasurer and office manager of the company's home office in New York; salary three thousand per annum to commence, to be advanced to five or six thousand per annum; must be a capable man for his position, and be prepared to immediately invest fifty thousand dollars in the company's preferred stock paying 7 per cent. annual dividends quarterly; first class references given and expected. Box 803, AMER. MACHINIST.

Wanted—Energetic salesmen, in all sections, now calling on machine shops, etc., to handle clean, profitable and satisfactory article as side line; state territory covered and give full details regarding selling experience; also several references; this is an excellent opportunity for right men. Box 851, AM. MA.

Wanted—An assistant foreman for the grinding department of an eastern firm doing a line of high grade automobile work; applicant must have had, and be able to hold a position of responsibility in this line of work, and to be considered must give experience, class of work and name firms worked for during past five years; state whether married or single, wages expected and when available; this is an extraordinary opportunity for a first-class executive; present employers will not be referred to if so requested. Address "Executive," AMERICAN MACHINIST.

A large, well established company, making special patent machinery with offices and factories in different countries, has a vacancy for a capable, energetic uptodate business man of unimpeachable integrity, to take charge of their main American office located in New York; must be able to invest at once $75,000 in the company's preferred stock paying quarterly dividends at the rate of 7 per cent. per annum; salary to commence, $3500 per annum, to be advanced to six thousand in the course of time; full investigation and references required and given. Box 802, AMERICAN MACHINIST.

OHIO

Wanted—Foundry foreman by automobile company in middle West; give full details of past experiences, also references. Box 886, AMERICAN MACHINIST.

Wanted—Assistant chief draftsman; applicant must be thoroughly experienced in machine tool design and preferably in lathe design; in answering, give as complete an account of yourself as possible, to avoid unnecessary correspondence. Box 845, AM. MA.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Wanted—Draftsman on installation of refrigerating machinery; state age, experience and expected salary. Box 820, AMER. MACH.

Diemaker on small sheet metal specialties; state experience fully and wages at first; growing concern, hence chance for advancement. Wolverine Mfg. Co., Pittsburg, Penn.

Wanted—Instructors in mechanical and electrical engineering and mechanical drawing in an eastern institution; graduates from technical schools, preferably with one or two years' practical experience. Address with references, Box 829, AMER. MACHINIST.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

RHODE ISLAND

Wanted—Fifty tool designers; experienced competent men in the design of jigs, fixtures, punches and dies and other special tools used in the manufacture of high grade machine parts on an interchangeable basis; apply by letter stating age, experience and salary required, as well as the date when you would be able to start if application was accepted. The Taft-Peirce Manufacturing Company, Woonsocket, R. I.

WISCONSIN

Wanted at Once—Expert tool designer and machine shop foreman; thorough mechanic having experience with good machine shop practice and production; state actual experience, age, references and salary expected. Box 764, AMERICAN MACHINIST.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

MICHIGAN

Manager or superintendent desires change; thoroughly familiar with modern methods; capable of taking entire charge of manufacturing plant; experience with and references from well known firms; satisfactory reason for change. Box 876, AMER. MACHINIST.

Mr. President: Are you satisfied with the earnings of your company? If not, why not get new ideas from a man of twenty-four years' practical, uptodate experience with some of the largest firms in this country; confidential. Box 877, AMER. MACHINIST.

NEW JERSEY

Draftsman, designer, German descent, having broad shop experience and technical education, wishes position with manufacturing plant or office. Box 889, AMER. MACHINIST.

Superintendent or assistant superintendent; 20 years' practical experience on general machine and tool work; uptodate in organization and cost systems; best of references. Box 834, AMERICAN MACHINIST.

NEW YORK

Wanted—Position as assistant foreman on Jones & Lamson turret lathes where first class work is required. Box 882, AMER. MACH.

Situation wanted by expert mechanical draftsman in New York city; six years' shop experience. Box 875, AMERICAN MACHINIST.

Draftsman wishes a permanent position with chance for advancement; technically educated; two years' drafting, one year foundry experience. Box 887, AMER. MACHINIST.

Toolmaker or machinist; young man well trained to close work on tools and jigs, can work on bench and all tools; three years' experience as all-around man. Box 893, AM. M.

Superintendent, technical training, with high executive ability, wishes to change position; 15 years' experience in electro-mechanical and special machinery; first class designer, with common sense, inventive ability. Box 856, AMERICAN MACHINIST.

Practical man, 28, having had ten years' experience as tool and die maker, machinist and draftsman, three years' experience on road selling machine tools, uptodate both business and practical, wishes change, responsible position. Box 883, AMER. MACHINIST.

Mechanical engineer, twenty years' experience in erecting rope tramways, bridges, piers and all kinds of machinery, in the United States, Mexico and South America; capable of taking charge and installing any plant. Mr. G. D. Harrington, 150 Nassau St., New York, N. Y.

Graduate mechanical engineer, nine years' general experience, five years with air compressor builders, design, testing, development of electric driven units, special problems in air and natural gas compression, sales engineering and publicity work, wants responsible position with compressor builders; at present employed. Box 770, AMER. MACH.

Technical graduate of Cornell University, having had five years' manufacturing experience with largest machinery firms, covering shop work, sales, correspondence, special work in systematizing and costs, in developing economies in production and efficiency in operation, in organizing and executive work, desires position as superintendent or manager of small company, or as special production and cost man for large firm; best of references and recommendations; full particulars on request; interviews desired. Box 895, AMERICAN MACHINIST.

OHIO

Toolmaker, with experience on spiral, worm and bevel gears, and the care of automatic machinery, wants position. Box 872, AM. M.

Secretary or correspondent—Young man of 27, ten years' all-around experience, desires responsible position with growing concern; five years in machine-tool business; expert stenographer. Box 826, AMER. MACH.

Position wanted as assistant superintendent by technical graduate, age 29; eight years' shop and drawing room experience with well known manufacturers of machine tools and special machinery; competent tool designer; thoroughly familiar with modern methods; executive ability; at present holds responsible position in tool designing department. Box 879, AMERICAN MACHINIST.

PENNSYLVANIA

Toolmaker with broad training and long experience on all kinds of tools, expert on dies, wishes position. Box 894, AM. MACH.

Mechanical engineer, 30, with 3½ years' shop and 1 year drafting experience; preferably position with company manufacturing gas, steam engines or turbines. Box 878, AMERICAN MACHINIST.

WISCONSIN

A-1 machinist and toolmaker, eight years' experience, college education, competent to handle men, wants position as machine shop or tool room foreman about July 1; best references. Box 881, AMERICAN MACHINIST.

FOR SALE

For Sale—14 fine bound volumes of the AMERICAN MACHINIST. C. A. Rogers, Des Moines, Iowa.

Complete set new patterns and drawings for 30- and 36-inch light radial drill, modern design. A. Pletz, 132 E. Forest Ave., Detroit, Mich.

For Sale—Gear cutters for cutting spur gears up to 2 diametrical pitch, one 48-inch Bultman machine; also one 30-inch same type, for cutting up to 2½ diametrical pitch. Address Northern Engineering Works, Detroit, Mich.

For Sale—One Harrisburg standard cross-compound engine, 13 and 23 by 15, direct connected to a 150-kilowatt Westinghouse, 2-phase, 60-cycle, 240-volt generator; also one each 120-and 150-kilowatt Westinghouse, 2-phase, 60-cycle, 300-volt belted generators. Standard Roller Bearing Company, Philadelphia, Penn.

For Sale—Machinery: 1 Van Norman milling machine, complete with the dividing head, arbors, etc.; 1 No. 18 Bliss punch press; 2 No. 19 Bliss punch presses; 1 No. 20 Bliss punch press; 1 cyanide case hardening furnace, complete with blower; 1 Dwight Slate drill press; 1 large cast iron tumbling barrel and 1⅛ inch Shuster riveting machine. Box 892, AMERICAN MACHINIST.

Talks With Our Readers

By The Sales Manager

A few days ago one of our Service Department men sat in the office of a firm which was about to begin an advertising campaign.

The firm consisted of two men, father and son. The subject under discussion was what they wanted to say in their ads.

"Now, dad," said the junior partner, "I've thought a lot about this advertising game lately. What we want to do is to say something strong, something like: 'This device is the best ever made. It will do three times as much work as any other and last twice as long!'"

"But it won't, Tom," said the father. "You know it won't."

"Of course it won't," the son went on, "but it sounds good and it will get us business. I tell you I believe we've got to talk big—to paralyze the readers."

The father turned to the Service man, who had been listening. "What do you think about it?" he asked.

"I don't believe in paralysis," was the reply, "but where did you get your idea?" he asked the young man.

"Well," he said, "you are going to write our ads and you've got to have something to talk about. A little exaggeration will help you; besides the readers won't believe it all anyway. We've got to put it stronger than it really is to get any of it over. Look at the business Barnum used to get by exaggerating in his advertising. Of course, we'll leave it to you, but if people believe only half they hear, you've got to make the half that's left pretty convincing."

Whereat the Service man arose and took the floor.

"If these were the principles on which you manufacture your article," said he, "I wouldn't bother to argue with you. I couldn't write your ads, and you couldn't buy space in my paper. But I happen to know that your product is a good one, honestly made, and that your only trouble is a woeful misunderstanding of modern advertising.

"In the first place you are wrong when you think that the readers will not believe what you say. They will, because modern advertisers stand back of their ads as they do back of their goods.

"And so will you.

"The days of exaggeration are past—you can't sell bad goods with good advertising any more than you can sell good goods with bad advertising, and you can't sell either by exaggerated claims.

"And even if an advertiser today could get a fake ad printed and get a number of readers to start business dealings with him—then he would be like the fellow who killed the goose that laid the 18-karat eggs.

"It isn't the publishers alone who have taught the readers to believe what they read in the advertising pages—it's the advertisers, the manufacturers who have built up confidence by telling the truth in their ads."

By now both father and son agreed with the Service man.

"To tell the truth," said the father, "is always best—it's the Sixth Commandment of Moses."

"It's the First and all the other Commandments of Advertising," replied the Service man. "In this enlightened age a manufacturer is known not by the company he keeps, but by the advertising he does."

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Only reliable products can be continuously advertised.